



Report to the Department of Health

National Evaluation of Payment by Results

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Shelley Farrar¹, Jon Sussex², Deokhee Yi¹, Matt Sutton¹, Martin Chalkley³, Tony Scott⁴, Ada Ma¹

1. Health Economics Research Unit, University of Aberdeen
2. Office of Health Economics, London
3. Department of Economic Studies, University of Dundee
4. University of Melbourne



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Chapter 1. Short report

1.1 Introduction

In April 2002 the Department of Health (DH) in England outlined its plans to introduce a new system of financing hospitals called 'Payment by Results' (PbR). The new payment system uses a nationally fixed case-mix based tariff, which reimburses hospitals for the amount and type of care they provide. The introduction of PbR marks a fundamental change in the way in which hospitals in England are financed. It was motivated by a desire to effect changes in the decision making processes and ultimately the outcomes of decisions in respect of the efficiency, volume of activity and appropriateness / quality of care in English NHS hospitals.

This report provides details of an evaluation of the process and effects of the introduction of PbR. The analysis that we report covers the period from 2002/3 to 2005/6.

Key objectives for this study were agreed with the DH. These were to:

- a) Examine the process of policy implementation
- b) Examine the impact of the policy on a number of key outcomes.

We present our report in two parts; in this chapter we provide a short version of our report, whilst chapters 2, 3, 4 and 5 provide the details of the analysis that was undertaken and provide the evidence in support of our findings.

We approached our task in a structured manner that is reflected in the ordering of material in this report.

We started by gathering information on the nature of the PbR policy, the timing of its introduction and the system that it was replacing. This material is presented in Section 1.2 of this chapter and Chapter 2. Also in those sections we briefly describe the financing system for NHS hospitals in Scotland because our subsequent quantitative analysis relies on making comparisons which enable us to isolate the impact of the changing payment system from the many other changes impacting on hospitals – the

Scottish NHS provides a powerful comparator for that purpose. PbR was introduced with the intention of achieving a broad range of objectives relating to hospital and health care system performance; we also identify these in Section 1.2 and Chapter 2.

A conceptual framework is necessary in order to understand how changing the payment system can impact upon decisions and outcomes and whether it can be expected to achieve its objectives. For this purpose we used, and subsequently developed, an economic framework which considers the incentives for decision makers when faced with different financing systems. This is the material set out in Section 1.3 and Chapter 3. Contract theory, as this branch of economics is referred to, is very extensive and our purpose in this phase of the analysis was not to attempt to review the literature but rather to distil its key conclusions as they might apply to PbR. However in one important regard – the link between the PbR system and incentives to expand activity – we could not find any strictly relevant economic models and so developed a simple extension of an existing model in order to better understand the issue.

The empirical phase of our research is described in two sections and chapters.

In Section 1.4 and Chapter 4 we present the details and findings of interviews that were conducted with decision makers in the NHS. This part of our research has two key objectives. First, because we accept that our economic framework can only be valid if the circumstances it seeks to analyse come into existence and if the preconditions or assumptions upon which it is based are valid, our qualitative analysis was used to assess these preconditions. Second, the qualitative analysis provides insight into whether there are features of the PbR system that we have failed to incorporate into our analysis that are nevertheless relevant to decision makers.

The longest and most substantial part of the evaluation is a quantitative / econometric analysis of the linkages between the introduction of PbR and observable changes in key aspects of performance of the hospital care system, specifically efficiency (cost per treatment), volume of activity and appropriateness / quality of care. This is contained in Section 1.5 and Chapter 5. Ultimately evaluation rests upon establishing whether or not PbR achieved what it set out to achieve and in this section (chapter) we

focus on the observable aspects, or analogues of, those goals. Our quantitative analysis is substantial both because it is central to evaluation and because the issues involved in attempting to isolate the impact of policy from the myriad of other influences on performance are extremely complex. We have approached this empirically by (i) developing a unique data resource, constructed using the large and growing administrative data sets being generated by the NHS and (ii) applying multiple difference in difference methodology in order to infer the impact of PbR on the key outcomes. We believe that the tools that we have developed will be of value to the DH and other researchers concerned with the operation of the NHS beyond their application to our evaluation.

Section 1.6 of the short report does not have a supporting chapter as it is concerned simply with summarising the results of our evaluation as a whole.

1.2 The Payment by Results Policy

Under PbR hospitals are paid according to the number and type of patients that they treat through a system in which prices are determined in advance. In common with many other health care systems PbR ensures that the provision of hospital services is financed using a mechanism that makes a direct link between volume and case-mix of output and hospital income (Sussex and Street, 2005).

Prior to PbR a range of purchasing arrangements were used in the English NHS. These were called, variously, block contracts, sophisticated block contracts, cost and volume contracts and cost per case contracts. These contracts specify in one form or another, a payment for a broad range of health services and treatments. The more commonly used ‘sophisticated’ block contract, introduced pre-defined maximum and minimum levels of provision. Output levels outside of these targets triggered predefined actions; these could be renegotiations or data validation procedures (Raftery *et al*, 1996).

Under PbR, prices are defined in terms of Healthcare Resource Group (HRG) spells of stay in hospital. A spell of activity is a hospital stay from admission to discharge and is a measure of hospital output. A spell might cover one or more episodes. An

HRG code is assigned to each spell of activity and where that spell consists of multiple episodes, the dominant episode determines the HRG code. There were 550 tariffed HRGs for admitted care under the HRG Version 3.5 (DH, 2003a, 2003b, 2003c, 2004a).

There are various characteristics of the tariff system which are pertinent to our study and which shape the incentives of the system. The payment the hospitals receives for providing an HRG spell is determined by whether that spell is pre-planned (elective) or not (non-elective) and reflects the difference in costs associated with the two types of patients (DH, 2004b). A single tariff exists to reimburse trusts for each HRG for daycase and inpatient elective care (DH, 2002a). Tariffs have also been introduced to reimburse hospitals for the provision of outpatient services. The tariff for these is defined by speciality and, in the main, is paid per attendance (DH 2005). In 2005/06, an attendance-based tariff (for three categories of patient) was also introduced for accident and emergency care (DH, 2004c).

There are a number of key steps in the construction of the tariff. Reference costs are used to calculate the national average cost. These are then adjusted equally for all providers in various ways to reflect changes in costs over time associated with inflation, technology and efficiency improvements. In addition some tariffs are adjusted to take into account National Institute for Health and Clinical Excellence guidelines. At a separate stage in the reimbursement process the tariff is then adjusted using the Market Forces Factor (MFF) to give a local price for each Trust reflecting unavoidable local differences in costs (DH, 2004b).

PbR has been introduced in a phased fashion. It was first applied to marginal changes in output for 15 HRGs in 2003/4 (DH, 2002a) and extended to a further 33 HRGs in 2004/5 (DH, 2004b, Appendix 7). The tariff was used to commission activity growth above the baseline of Service Level Agreements. For Trusts which did not deliver the agreed level of elective activity, funds were withdrawn at the rate of the tariff. The 15 and 33 HRGs are listed in Table 1 of Appendix G. For a subset of NHS Trusts,

Foundation Trusts (FTs), it was applied to most inpatient (with some exceptions¹), day case and outpatient output (again with exceptions) in 2004/5. For the remaining Trusts, it was applied to most elective admissions in 2005/6 (again with exceptions) and then to outpatients in 2006/07 (DH, 2004c).

Transitional arrangements for the tariff have been implemented which offer Trusts some protection from the financial penalties of having costs above tariff. Further refinements and development of PbR, beyond the scope and timetable of this project, and details of the tariffs are published on the DH website at <http://www.dh.gov.uk/en/Policyandguidance/Organisationpolicy/Financeandplanning/NHSFinancialReforms/index.htm>.

PbR represents one component of the modernisation and reform programme announced in the NHS Plan (DH, 2000a). These other reform instruments have been introduced throughout the period covered by this study and have the potential to interact with PbR and affect its impact. The main changes in health care policy applying in the period from 2002/03 onwards which might be expected to affect the results of our analyses are:

- Shorter waiting times targets;
- introduction of an active policy of patient choice of provider for elective hospital care;
- creation of 'Foundation Trusts' with some devolved powers not available to other NHS Trusts;
- greater support of independent sector provision of hospital services to NHS patients and;
- introduction of practice based commissioning, i.e. giving all primary care practices indicative budgets from which to buy health care for their registered patients.

¹ Some HRGs are excluded from tariff on the basis that they were low volume, had volatile costs and/or were of a specialised nature. These are listed in Table 2 of Appendix D.

Because part of our analysis draws on a comparison of quantitative data in England and Scotland, we identify important differences and similarities between the structure and policy context of the NHS in England and the NHS in Scotland.

Patient choice, Foundation Trusts and Practice based Commissioning have not been adopted in Scotland. Since devolution the Scottish Government has placed greater emphasis on central planning. Although, like England, Scotland had used waiting time targets to stimulate improved performance, generally, the regime in Scotland is considered to be less ‘aggressive’ (Propper *et al*, 2007). In 2005/06 a national tariff was introduced in Scotland but during the period of our study was essentially a shadow system which did not affect the flow of funds (Scottish Executive Health Department, 2005). As a result we are able to treat the funding of NHS Boards as unchanged during our period of study.

Although it is possible to identify considerable differences in the details of the health policy of the two countries, on an international setting, given the possibilities in health care system design, there are considerable similarities between the Scottish and English health care systems. The two countries have essentially shared the same financing mechanisms and broad policy developments until The Scotland Act 1998. Both systems are predominantly funded through general taxation and provide services free at the point of consumption. They each use family doctors as gatekeepers to secondary care services. They also have the same nationally agreed (UK) contracts for consultants, nurses and GPs.

In a natural experiment the ideal control would be similar in all ways to the group subject to policy change. Such situations are rare in public policy. However, the NHS in Scotland does provide a structure similar to English NHS and importantly one which has been relatively stable in its financing of hospitals at the time of the implementation of PbR. As a result, we consider the NHS in Scotland to provide a useful control in our analysis.

The key document introducing PbR policy was ‘*Reforming NHS Financial Flows*’ (Department of Health, 2002a). This document identified three main reasons for introducing a standard price tariff (Page 13):

- To ‘enable PCT commissioners to focus on the quality and volume of services provided’
- To ‘incentivise NHS Trusts to manage costs efficiently’.
- To ‘create greater transparency and planning certainty in the system.’

These objectives suggest linkages between the adoption of PbR, change in the behaviour of decision-makers and subsequent changes in the performance of the NHS hospital system. The remainder of our evaluation is based upon exploring the nature of these linkages. We do so first using the tools and concepts of economic theory (Chapter 3) summarised in Section 1.3 and then empirically using both qualitative (Chapter 4) and quantitative (Chapter 5) methods summarised in Sections 1.4 and 1.5, respectively.

1.3 The link between Payment by Results and outcomes – theoretical considerations

The economic analysis of the impact of payments systems on outcomes rests upon what is called contract theory. In contract theory the concern is to determine how particular payment mechanisms affect *incentives* which are required whenever the purchaser cannot specify exactly the actions of the supplier. These kinds of incentive issues pervade health care in respect of cost and quality of health care.

It is useful to characterise PbR as impacting upon three aspects of payment – the extent to which that payment responds to or is sensitive to variations in cost, volume and case-mix.

Relative to the financing arrangements in place prior to its adoption, PbR reduces the extent to which hospitals can utilise their own cost circumstances to negotiate for higher payment – either in the current period or in the future. This feature of fixed price payment systems for health care has been very extensively discussed in the contract theory literature. The argument that is made is that reduced cost sensitivity gives rise to increased incentives to control costs.

Since one driver of costs is the quality of care delivered there has been a great deal of attention given to the possibility that fixed price payment systems might compromise quality of care. The implications are that PbR might be expected to reduce unit costs but may compromise quality of care. There are a large number of refinements of this argument and these are set out in detail in Chapter 3 but the central point is a fairly robust one – reduced cost sensitivity of payments gives rise to incentives to reduce costs.

The relationship between cost and efficiency needs, however, to be treated with care. If unit costs could be observed and were to fall this might be either because of efficiency savings or because of reductions in service quality. With that caveat, the objective that DH set for PbR “To incentivise NHS Trusts to manage costs efficiently” finds support from the economic theory of contracting.

PbR makes an explicit link between the number of patients treated and the payment to a hospital whereas existing arrangements left this link poorly defined. Therefore, it is reasonable to treat PbR as a more volume sensitive payment system. In various places this is indicated as providing an incentive to increase volumes (i.e. the number of treatments).

The logic of this seems clear: making an explicit payment for additional treatments adds to the value of providing more of those treatments as far as the decision maker is concerned. However, we find that when we examine this idea in the light of formal (but simple) economic models of incentives it is less clear cut. The intuition is that a rational decision maker needs to take into account both benefit (the payment) and cost and it is the margin of benefit over cost that provides the incentive.

In a complex health care setting where there are capacity constraints, where some forms of treatment are in excess demand and others are not and where the allocation of costs across different treatments is unclear the impact of PbR on this margin will vary across HRGs. Some may well be incentivised from the perspective of increased treatment but others may exhibit the opposite incentive – a desire to reduce treatment in one HRG in order to focus on another more remunerative one. Thus we do not find

that the theory supports a view that PbR will necessarily incentivise greater volume. The details are again set out in Chapter 3.

Pre-PbR contracts tended to group together large numbers of services – or in the new terminology they lumped together HRGs. In separating out HRGs for individual payment, PbR allows for a greater sensitivity of payment to the precise mix of patients that a hospital treats. There are two lessons in respect of case-mix sensitivity from the economics framework that we have considered; one simple and one more complex. In simple terms separating out different types of patients for different treatments allows payments (prices) to be more closely aligned with the requirements of treatment and thus obviates the need to build a payment cushion into a hospital's finances. Against this benefit the complexity, and thus one presumes cost, of administering the payment system is increased.

More complex, are issues that arise when, as in any real world case-mix sensitive system, hospitals have discretion over which HRG a patient might be allocated to. The issue here is that separated payments may give rise to incentives to distort the allocation of patients to different payment categories. These kinds of effects are sometimes referred to generically as 'gaming'². The economic theory as to how to optimally structure payment in such circumstances is complex but it suggests that it may be important as PbR continues to develop to monitor the allocation of patients to HRGs.

The theoretical framework thus provides a means of establishing the nature of the expected linkages between the change to PbR and resulting behaviour of decision makers and outcomes. Our analysis suggests that in terms of observable outcomes we should examine:

- the effect of PbR on the unit costs of treatment,
- the effect on the quality of care and
- the effect on volumes of treatments.

² This refers to just one type of gaming behaviour, other types are possible.

These examinations constitute the substance of our quantitative analysis.

Our framework, as with any economic analysis, rests upon a number of assumptions or pre-conditions. Most importantly, the PbR system needs to be implemented as assumed and decision makers need to have an understanding of and the means to respond to the incentives that we presume it to entail. These issues are examined as a part of our qualitative analysis.

1.4 Qualitative analysis of Payment by Results

In the previous section the economic rationale for the linkages between PbR policy and the expected outcomes with respect to NHS hospital performance was set out. These linkages will work best when pre-conditions are met. Crucially the policy should be implemented as intended and decision-makers should understand and be able to respond to the incentives. Through a series of semi-structured interviews we explored issues relating to the implementation of PbR and the perception and experiences of decision-makers.

The qualitative analysis complements the quantitative analysis and has four objectives:

1. To develop an understanding of how the PbR policy is perceived in the NHS and whether those perceptions align with the assumptions of the theoretical analysis,
2. To assess how PbR is being implemented in practice and whether it generates the kinds of incentives that are suggested by the theoretical framework.
3. To identify perceived drivers of (and obstacles to) implementation, by drawing on the experiences of key stakeholders in the implementation and application of PbR policy.
4. To inform further development of the theoretical analysis of PbR and to support and aid the interpretation of the quantitative analysis.

Data for the qualitative analysis were collected in three rounds of semi-structured interviews with key stakeholders in the NHS. During the preparation stage of each round of interviews, the scope of the questions and the categories of interviewees,

were agreed with the DH steering group for the project. Some of the same subject areas are examined in more than one round but each round had a different emphasis reflecting the embedding of the PbR in the NHS and the emerging findings in the quantitative empirical work. The first round of interviews focussed on objectives (1) and (2), the second on objectives (2) and (3), and the third round of interviews focussed on objectives (1) and (4).

We endeavoured to elicit a range of views and experiences by targeting our interviewees from organisations operating in different types of local conditions and with different characteristics. For instance, we sought interviews with decision-makers from organisations in rural and urban areas, from organisations providing tertiary and secondary care and from organisations with different financial positions.

The material from the interviews suggests that the interviewees had a good understanding of how PbR was intended to operate and the intended incentives with respect to efficiency, volume and quality of care. However, there was some scepticism as to whether the mechanism of PbR would act in the way intended by the policy makers. Some of this related to the technical aspects of PbR such as the credibility of the tariff in terms of how well it reflects average costs, how well or otherwise HRGs capture the outputs of the hospitals, their lack of knowledge of their own organisations cost structures and whether the PbR system, and specifically the tariffs, will remain stable. Such scepticism was suggested as resulting in a reluctance to change their existing pattern of service provision in response to the incentives whilst there existed uncertainty about the sustainability of changes and the robustness of the information used to inform changes.

In addition, issues of NHS culture and behavioural norms were raised by the interviewees, as affecting their responses to the incentives of the new system. For instance, a number of interviewees would not pursue greater revenues through increased supply if this was an action considered detrimental to the financial status of the commissioner and the local health economy as a whole.

We examine here how the interviewees considered their response to PbR would be in terms of the specific objectives outlined in the policy documentation.

On the basis of the responses of those interviewees, it might be expected that PbR would have added little further incentive to increase efficiency above those influences that already existed: principally the elective waiting time targets – mentioned frequently by interviewees – and the penalties for failure to achieve financial break-even.

We asked interviewees in all three rounds of qualitative analysis about their perceptions of whether and how PbR was affecting the volume of activity undertaken in their local health economies. Most respondents identified increases in activity but were inclined to attribute this to continuations of past trends and to the pressure to reduce waiting times for elective care. They cited lack of demand and capacity as constraints on their ability to increase volume.

From early interviews it was feared PbR might damage patient quality, or at least deter improvements, in some places because of the need to keep costs below the nationally fixed tariff level. One interviewee feared that because the PbR tariff is based on national average costs it would produce “average quality services”. Others expected no impact on quality. This last view was generally retained into later interviews but we did hear occasional individual examples of both kinds of impact: quality improvements and quality reductions.

In summary, our interviewees were broadly sceptical that PbR would have real effects of the kind hoped for by policy-makers or predicted by economic analysis. Whether their scepticism is justified can be assessed in the light of the quantitative analysis that we report in Chapter 5.

1.5 Quantitative analysis of Payment by Results

In Chapter 5 we examine the linkages between PbR policy and measurable outcomes using quantitative methods. The nature of the linkages is informed by the tools and concepts of economic theory in section 1.3 (and in detail in Chapter 3). The measurable outcomes are defined with reference to this theory and the objectives of the PbR outlined in section 1.2 (Chapter 2 in more detail). Section 1.4 (Chapter 4) has

given potential insight into whether the linkages work as intended and what factors contribute or hinder that which will be useful in interpreting and explaining the results.

We used the international literature, the objectives of the policy and the theoretical analysis and discussions with the project advisory group to guide the choice of appropriate outcome measures in the quantitative evaluation of PbR. We use length of stay and the day case as a proportion of elective admissions as our two main measure of unit costs or efficiency for hospital admissions. For outpatient services we use the ratio of subsequent to first attendances and the ‘did not attend’ rate.

For volume of care we use the unit of reimbursement, i.e. the spell of care, for admissions and attendances, for outpatient care.

For quality of care we follow convention and employ in-hospital mortality, 30-day post surgical mortality and emergency readmission following treatment for hip fracture.

We also investigate specific pairs and groups of HRGs for evidence of changes in coding and/or treatment practice.

Method

Our evaluation challenge was to measure the effect of the introduction of PbR on hospital behaviour. We seek to measure the effect of the policy on the targeted HRGs and Trusts. We require estimates of what would have happened if the tariff had not been introduced. We construct this control group using a ‘difference-in-difference’ (DiD) framework (Blundell and Costa Dias, 2000) and compare the changes over time in the outcome variables for HRGs funded by tariff with the same outcome variables in HRGs not funded by the tariff, before and after the tariff’s introduction.

The phased introduction of the policy represents a series of quasi-experiments. Since there are several DiDs available, it is important to choose control groups that are most appropriate for the research questions being answered. In the face of these choices, we used two criteria for selecting the control group.

1. *The control group remains the same the year after the comparison*
2. *The tariff is applied in full not just at the margin.*

We use differences between the phasing in of PbR by FTs, non-FTs and Scotland (which does not introduce tariffs during our study period in any meaningful way) to estimate the effects of the introduction of the policy. We make comparisons between; FTs and non-FTs in 2004/5; FTs and Scotland in 2004/5 and 2005/6; non-FTs and Scotland in 2005/6; low cost and high cost non-FTs in 2005/6 and; Trusts in ‘in-deficit’ and ‘in-surplus’ health economies in 2004/5 and 2005/6.

The majority of our analysis is undertaken at spell level. Details of the econometric modelling are provided in Appendix B.

We use fixed effects to control for differences between the characteristics of HRGs and Trusts that are unobserved but remain constant over time. Examples of such Trust-level characteristics are management culture, teaching status, and local population characteristics. HRG-level unobserved factors include specialty-specific factors, patient demographics and case mix. We also control for age-sex composition.

Results

We present results on our analysis of admissions data, outpatient data and effects within specific HRGs.

Impact on unit costs

The message on unit costs is consistent across most of the DiD analyses: unit costs have fallen more quickly where PbR was implemented. Table 1.1 shows the DiD results for the impact on length of stay and the proportion of daycases. For length of stay the negative coefficients indicate that length of stay has fallen more quickly where PbR has been implemented. Both FT and non-FTs appear to have responded in the expected way to the incentives associated with PbR.

For day case proportions, the positive coefficients indicate that the proportion of elective care provided as day cases has increased more quickly where PbR has been

implemented. Again this change is observed for both FTs and non-FTs. In addition, high cost providers have increased the proportion of daycases more quickly than low cost providers.

We demonstrate below that there has been little if any measurable change in the quality of care. This suggests that the reductions in unit costs have been achieved without detrimental impact on the quality of care measures used in our study. If these adequately capture the quality of care, it is fair to suggest that the reductions in unit costs have been achieved through improvements in the efficiency of the delivery of care.

Table 1.1 Effects of tariff on unit costs: mean length of stay and daycase proportion

Treatment	Control	Restriction	Year	Difference in changes in length of stay	Difference in changes in daycase proportion
FTs	Non-FTs		04/05	+0.5%**	+0.4% pts**
FTs	Scotland		04/05	-2.3%**	+0.4% pts**
FTs	Scotland		03/04-05/06	-4.9%**	+1.5% pts**
Non-FTs	Scotland	Elective	05/06	-1.2%**	+0.8% pts**
Non-FTs	Scotland	Non-elective	05/06	-3.9%**	N/A
Elective	Non-elective	Non-FTs	05/06	-0.7%**	N/A
High cost non-FTs	Low cost non-FTs	Elective	05/06	-0.02% [‡]	+0.25% pts**
High cost non-FTs	Low cost non-FTs	Non-elective	05/06	N/A	N/A

Notes: After adjustment for age-sex composition and Trust and HRG effects. [‡] not significant, * at 95 per cent, ** at 99 per cent

Impact on volume of spells

Using Scotland as the control group we found that both FTs and non-FTs have growth associated with the introduction of PbR. However, the one opportunity to compare the response of FTs to non-FTs in 2004/5 shows that FTs under tariff that year did not increase growth relative to the non-FTs. This last result is counter to what we would expect and suggests that there may be changes in policies other than PbR, e.g. waiting time targets, affecting the growth in the volume of care in England which we have not been able to control for in our analysis.

The proportion of non-elective activity is not shown to have increased in response to the introduction of the tariff.

Table 1.2 summarises the DiD results for the growth in volume of elective and non-elective spells and the proportion of non-elective spells.

Table 1.2 Effects of tariff on volume of care: all spells and non-elective proportion

Treatment	Control	Restriction	Year	Difference in growth in volume	Difference in changes in non-elective proportion
FTs	Non-FTs		04/05	−0.25% pts‡	−0.1% pts‡
FTs	Scotland		04/05	+1.33% pts*	+0.1% pts‡
FTs	Scotland		03/04-05/06	+4.95% pts**	+0.02% pts‡
Non-FTs	Scotland	Elective	05/06	+2.57% pts**	N/A
Non-FTs	Scotland	Non-elective	05/06	+3.21% pts**	N/A
Elective	Non-elective	Non-FTs	05/06	+0.76% pts‡	N/A
High cost non-FTs	Low cost non-FTs	Elective	05/06	+1.04% pts‡	N/A
High cost non-FTs	Low cost non-FTs	Non-elective	05/06	+3.09% pts**	N/A
Non-FTs in surplus	Non-FTs in deficit	Elective	05/06	−3.27% pts**	N/A

Notes: After adjustment for age-sex composition and Trust and HRG effects. ‡ not significant, * at 95 per cent, ** at 99 per cent

Impact on the quality of care

We found little evidence of an association between the introduction of the tariff and a change in the quality of care. Table 1.3 shows the DiD results for the three variables we used to measure quality: in-hospital mortality, 30-day post surgical mortality and emergency readmission following treatment for hip fracture. The only result with statistical significance is the difference in the change in in-hospital mortality for FTs compared to Scotland. A difference emerges when we look at the longer term effects, i.e. two years of impact of PbR. This provides one piece of evidence that the quality of care for FTs has increased (represented by a reduction in the in-hospital mortality

rate) in association with the introduction of the tariff. There are no results supporting the proposition that quality of care would suffer as a result of PbR.

Table 1.3 Effects of tariff on quality of care: in-hospital mortality, 30-day post surgical mortality and emergency readmission following treatment for hip fracture

Treatment	Control	Restriction	Year	Difference in changes in hospital mortality	Difference in changes in 30-day mortality	Difference in changes in emergency readmissions
FTs	Non-FTs		04/5	+0.01% pts [‡]	+0.01% pts [‡]	−0.68% pts [‡]
FTs	Scotland		04/5	−0.05% pts [‡]	+0.03% pts [‡]	+0.73% pts [‡]
FTs	Scotland		03/04-05/06	−0.28% pts^{**}	−0.00% pts [‡]	−1.20% pts [‡]
Non-FTs	Scotland	Elective	05/6	−0.00% pts [‡]	−0.05% pts [‡]	0.00% pts [‡]
Non-FTs	Scotland	Non-elective	05/6	−0.23% pts^{**}	N/A	N/A
Elective	Non-elective	Non-FTs	05/6	+0.27% pts^{**}	N/A	N/A
High cost non-FTs	Low cost non-FTs		05/06	−0.06% pts^{**}	−0.05% pts^{**}	−0.10% pts [‡]

Notes: After adjustment for age-sex composition and Trust and HRG effects. ‡ not significant, * at 95 per cent, ** at 99 per cent

Outpatients

We undertook a series of analysis on seven variables measuring changes in the patterns of outpatient services. Our results clearly demonstrate that there has been only one statistically significant change in the pattern of outpatient provision which can be associated with the introduction of the outpatient tariff under the PbR system. These results are reported in full in Chapter 5.

HRG up-coding

There is evidence from the international literature that hospitals operating under a case-mix based financing system such as PbR may respond to the incentives in ways not intended by the policy makers. One such effect is up-coding whereby providers code patients into HRGs which attract higher tariffs. For instance, where a treatment has two different HRGs to which it can be assigned, one ‘with complications’ and one ‘without complications’, there is an incentive to up-code patients to the higher tariffed ‘with complications’. We have investigated six pairs or groups of HRGs for evidence of such activity. We examined changes in the proportions of ‘with complications’ in

maternity care and instances elsewhere (in hip replacement and head injuries) where such an unintended incentive, associated with differences in the tariffs, was perceived. We found very limited evidence of a change in the pattern of coding or treatment of patients associated with the introduction of tariff. Of the six investigations, we found that only the coding (or perhaps practice) of caesarean section by FTs and normal delivery by non-FTs had changed in the direction expected if up-coding is happening.

It should be noted that the introduction was expected to be accompanied by greater transparency in the system and that the system encourages more accurate and complete coding of patients. It is not possible from this analysis to determine whether the very limited up-coding we identified was inappropriate or due to increased accuracy.

1.6 Conclusion

Our evaluation of PbR has involved a number of substantive elements: an exploration and extension of an appropriate theoretical framework, conducting an analysing semi-structured interviews and econometric modelling. These three components fit together to provide a means of assessing and understanding the impact of PbR on a number of key performance measures in the NHS. Each element also provides important insights in its own right.

The theoretical framework supports the view that a fixed national tariff will lead to downward pressure on unit costs that at least potentially will result from efficiency savings. Trusts with costs above tariff price levels have a clear incentive to reduce costs so as to avoid financial losses; and Trusts with costs below tariff have an, albeit probably weaker, incentive to continue to press for lower unit costs as resultant surpluses can be spent in part or in whole on non-tariffed activities or aspects of quality of care. The framework has further drawn attention to some weaknesses in establishing an unambiguous link between a more volume sensitive payments system such as PbR and activity levels. In complex health care systems such as the NHS there may be many countervailing incentives – such as capacity constraints.

From the interviews we elicited a willingness to work with the PbR policy and a general acceptance that it had been implemented successfully. But we encountered scepticism as to whether it would achieve its objectives. We also identified reported behaviours and attitudes which would not be conducive to achieving some of the objectives. Some of these constraints on PbR may need to be addressed in the future.

Our substantive quantitative analysis of the effects of PbR on key outcomes provides evidence that there have been reductions in unit costs of care which are associated with the introduction of PbR in England in its early years of implementation. There is less unequivocal evidence that PbR has stimulated increases in the volume of spells. For volume of outpatients, there has been no discernible impact on the volume or return ratio. With respect to quality of care the evidence needs to be treated with caution because in common with other researchers we have been limited in our ability to proxy the complexity that is 'quality' of health care. Nevertheless we have not found any evidence that PbR has had a negative impact on the generally accepted mortality measures. This suggests that the reductions in unit costs may have been achieved without detrimental impact on the quality of care, at least in as far as these are measured by our variables.

Taken together the analysis suggests that PbR is capable of achieving, and has in the short time since its adoption actually achieved real changes in hospital health delivery in England. Looking forward, our evaluation suggests a potentially rich set of further research questions. Our approach has of necessity been a general one. There is much still to learn about the impact of PbR at a more disaggregate level, for instance:

- (1) Into the differential impact of PbR across different HRGs
- (2) Into impact on different population groups (socio economic categories)
- (3) Into the pattern of response by Trusts and whether this is associated with observable differences in performance

Chapter 2. Payment by Results Policy

The focus of our study is the system of financing hospitals called ‘Payment by Results’ (PbR). Under PbR hospitals are paid according to the number and type of patients that they treat through a system in which prices are determined in advance. Prices are defined in terms of Healthcare Resource Group (HRG) spells of stay in hospital. The Department of Health for England (DH) outlined its plans to introduce PbR in April 2002 (DH, 2002a). The system has been phased in from 2003/04 and for acute care, the focus of our study, will be fully implemented by 2007/08. In common with many other health care systems PbR ensures that the provision of hospital services is financed using a mechanism that makes a direct link between volume and casemix of output and hospital income (Sussex and Street, 2005).

2.1 Hospital financing prior to PbR

Prior to PbR the commissioners and providers of hospital care in the English NHS used a range of different arrangements to fund hospitals. These were usually referred to as different forms of *contract*. Thus, block contracts, sophisticated block contracts, cost and volume contracts and cost per case contracts were terms used to describe purchasing arrangements. In essence these arrangements defined a broad range of services (e.g acute care) that a hospital was to provide and set a payment for those services.

Block contracts were the simplest form of payment, whereby, in return for a lump sum payment from the commissioner, the hospital Trust provides a defined range of services to a specified population. The more commonly used ‘sophisticated’ block contract, introduced pre-defined maximum and minimum levels of provision. Output levels outside of these targets triggered predefined actions. These could be renegotiations or data validation procedures (Raftery *et al*, 1996). Cost and volume contracts are similar to the block contracts in that a lump sum is agreed. However, under this contract form the volume of services to be provided is also pre-defined. Cost per case contracts were rare and involved Trusts being reimbursed on a case by case basis. They usually involved referrals not funded by other types of contracts (Goddard *et al*, 1997).

Information was not systematically collected on the forms of contracts that were used within the NHS. The most up to date information on the contract-type prior to the introduction of PbR is from a study undertaken for 1994/95 (Raftery *et al*, 1996) which showed sophisticated block contracts to be the most prevalent type, making up around 69 per cent of all major contracts. Cost and volume contracts accounted for 25 per cent; simple block contracts made up five per cent and; cost per case were used in only one per cent of major contracts.

2.2 The details of PbR

The prices (also termed the *national tariff*) developed and used under PbR financing system in the English NHS are specified in terms of ‘spells’ of activity. A spell of activity is a hospital stay from admission to discharge. The previous measure of activity in the NHS was the Finished Consultant Episode (FCE), which generated multiple records if a patient’s treatment was associated with more than one consultant. Patients with complex medical conditions might thus give rise to multiple FCEs and a spell might cover more than one finished consultant episode. For such a multiple-episode spell, the HRG code assigned is determined by the dominant episode. It is a measure of the unit of output of hospitals. The appropriate price / tariff is defined by the Healthcare Resource Group (HRG) into which the spell is coded. Spells which are clinically similar and require similar levels of resource use are coded into the same HRG. In this way the HRG is similar to the Diagnostic Related Group used in other such systems (Department of Health, 2003a, 2003b, 2003c, 2004a).

In the English health care system there are just over 600 HRGs in the version HRGV3.5 (which cover the period of the data used in our study) used to describe admitted care and, of those, 550 have an HRG-specific tariff. The payment the hospitals receives for a patient can be influenced by whether their spell is pre-planned (elective) or not (non-elective), reflecting the difference in costs associated with the two types of patients (Department of Health, 2004b). A single tariff exists to reimburse trusts for each HRG for daycase and inpatient elective care (Department of Health, 2002a).

Under PbR, tariffs have also been introduced to reimburse hospitals for the provision of outpatient services. The tariff for these is defined by speciality. In 2004/05, the first year of outpatient tariff, two types of tariffs were used. Most outpatient provision was funded on a per attendance basis with a higher tariff for the first attendance compared to subsequent attendances. A different type of tariff was applied to ten specialties: these were funded on an episode basis, whereby a fixed payment was made for the first and subsequent attendances which was not related to the number of total attendances (Department of Health, 2004b, Appendix 8). This system of episode based tariff for outpatients was not retained in subsequent years. As at 2005/06, there were 39 outpatient specialty tariffs and separate outpatient tariffs apply for adults and children (Department of Health 2005).

In 2005/06, an attendance-based tariff was introduced for accident and emergency care (Department of Health, 2004c). Three tariffs were created to reimburse for high cost, standard and minor injury unit attendances. Organisations are funded at tariff for their planned activity. Additional attendances will also be funded at full tariff. However, providers with activity below planned levels will have funds withdrawn at 20 per cent of tariff.

PbR tariffs are set at national average costs using reference cost returns of the previous two years. For example, for 2004/05, data from 2002/03 was used to produce an average cost for each HRG spell which would form the basis of the HRG spell tariff. The average cost tariff is then adjusted in various ways. To reflect changes in costs over time across all HRGs for all providers, the tariff is uplifted to account for changes in the underlying costs of delivering care with some downward adjustment for efficiency improvements. It is adjusted across some HRGs for all providers to reflect changes in technology and to reflect National Institute for Health and Clinical Excellence guidelines. At a separate stage in the reimbursement process the tariff is then adjusted using the Market Forces Factor (MFF) to give a local price for each Trust reflecting unavoidable local differences in costs (DH, 2004b). The aim of the MFF is take into account unavoidable local differences in the cost of providing health care services

PbR has been introduced in a phased fashion. It was first applied to marginal changes in output for 15 HRGs in 2003/4 (Department of Health, 2002a) and extended to a further 33 HRGs in 2004/5 (Department of Health, 2004b, Appendix 7). The tariff was used to commission activity growth above the baseline of Service Level Agreements. For Trusts which did not deliver the agreed level of elective activity, funds were withdrawn at the rate of the tariff. For a subset of NHS Trusts, Foundation Trusts³ (FTs), it was applied to most inpatient (with some exceptions⁴), day case and outpatient output (again with exceptions) in 2004/5. In addition, three non-FTs were ‘early implementers’ of the tariff, following the same pathway as the FTs⁵. For the remaining Trusts, it was applied to most elective admissions in 2005/6 (again with exceptions) and then to outpatients in 2006/07 (Department of Health, 2004c).

Transitional arrangements for the tariff have been implemented. Under these arrangements the NHS Trust is allowed to keep a percentage of the difference between tariff price and local cost (Department of Health, 2003c). Providers with local prices above tariff can retain the difference and those with local costs below the tariff must give up the difference⁶. The transition paths vary according to whether and when the Trust gained Foundation status.

The scope of the tariff for Non-FTs and FTs is illustrated in Table 2.1, whereby the pale boxes (checkered) indicate that the tariff was introduced to spells at the margin and the darker boxes (plain) where it was introduced to all spells (with the exceptions explained above) in that group of HRGs.

³ The highest performing NHS Trusts were given the option to apply for Foundation Trust status. The first wave of FTs were authorised in April 2004. Still part of the NHS, they have greater autonomy in decision-making, greater freedom to make and re-invest surpluses and access to public and private capital.

⁴ Some HRGs are excluded from tariff on the basis that they were low volume, had volatile costs and/or were of a specialised nature. These are listed in Table 2 of Appendix G.

⁵ Communication with Project Advisory Group.

⁶ Communication with Project Advisory Group.

Table 2.1 Scope of Payment by Results

	2003/04		2004/05		2005/06		2006/07	
	FTs	Non-FTs	FTs	Non-FTs	FTs	Non-FTs	FTs	Non-FTs
Elective spells: 15HRGs								
Elective spells: 33 HRGs								
Elective spells: other HRGs								
Non-elective spells								
Outpatients								

Note: checkered boxes indicate marginal application of the tariff. Plain shaded boxes indicate application of the tariff to all spells within the group of HRGs.

Details of the further refinement and development of PbR, beyond the scope and timetable of this project, and the tariffs are published on the Department of Health website at

<http://www.dh.gov.uk/en/Policyandguidance/Organisationpolicy/Financeandplanning/NHSFinancialReforms/index.htm>.

2.3 The broader context of reform

PbR represents one component of the modernisation and reform programme announced in the NHS Plan (DH, 2000a). These other reform instruments have been introduced throughout the period covered by this study and have the potential to interact with PbR and affect its impact. Below, we outline the other main changes in health care policy applying in the period from 2002/03 onwards which might affect the results of our analyses.

The major parallel policy reforms underway in the NHS in England which most affect the objectives and impact of PbR were introduced in the NHS Plan (Department of Health, 2000):

- Shorter waiting times targets;
- introduction of an active policy of patient choice of provider for elective hospital care;

- creation of 'Foundation Trusts' with some devolved powers not available to other NHS Trusts;
- greater support of independent sector provision of hospital services to NHS patients;
- introduction of practice based commissioning, i.e. giving all primary care practices indicative budgets from which to buy health care for their registered patients.

In the area of hospital elective care, a major feature of health care policy in England has been the succession of ever more challenging targets imposed by the Government to reduce patients' maximum waiting times. For elective inpatients and day cases the targets during the period of our study were:

- March 2002 – no-one waiting more than 15 months after decision to admit
- March 2003 – no-one waiting more than 12 months after decision to admit
- March 2004 – no-one waiting more than 9 months after decision to admit
- December 2005 – no-one waiting more than 6 months after decision to admit

These targets have been given very high priority, to the extent that failure to achieve them has been seen by senior NHS managers as career threatening (Bevan and Hood, 2006, Propper *et al*, 2007, Alvarez-Rosete *et al*, 2005). An additional target, to be achieved by the end of 2004, was a maximum 4-hour waiting time in A&E from arrival to admission. Various strategies have been used to meet these targets and there is evidence consistent with Trusts increasing emergency admissions as a way of meeting the A&E target (BMA, 2005). Together, the waiting time targets have provided a strong stimulus to Trusts to increase activity in order to achieve them.

A major policy theme in the NHS in England which PbR was intended to complement is the extension of patient choice over the hospital in which they are treated for elective procedures (Department of Health, 2000). The Department of Health introduced the first pilot schemes in 2002, giving patients who would otherwise have to wait more than six months for surgery the choice to go to an alternative provider for faster treatment. Evaluation of this London Patient Choice Project demonstrated

that the project led to shorter waiting times for patients (Dawson *et al*, 2007). The policy was launched throughout England in January 2006, since when most patients had a choice of at least four providers when they are referred for planned hospital care by their GP. PCTs are responsible for commissioning the menu of providers from which people can choose.

NHS Foundation Trust status was created in the NHS in England to incentivise high performing Trusts by permitting them some greater freedoms and flexibilities than other NHS Trusts in the way they manage their affairs, e.g. more freedom from Whitehall control and performance management by Strategic Health Authorities; easier access to (limited) capital funding and freedom to invest surpluses in developing new services (Department of Health, 2002b). The first Foundation Trusts were established in April 2004 and their numbers have progressively increased, reaching 73 by August 2007 (Monitor, 2007). As detailed in the previous section, in 2004/05 Foundation Trusts were subject to PbR arrangements in full, whereas other Trusts were introduced to it later.

The Department of Health has also actively stimulated the development of increased private sector provision of some elective hospital services (Department of Health, 2002c). In particular, starting in September 2003, the Department of Health has signed a series of contracts for independent sector treatment centres (ISTCs) with the aim of increasing capacity to treat NHS patients and providing a wider range of potential providers in support of patient choice policy. By the end of 2006, nine ISTCs were in operation. Nationally the ISTCs provide around one per cent of total NHS elective activity in England. Despite this small scale activity, there is anecdotal evidence that they have had a greater impact on the behaviour of adjacent NHS providers (Timmins, 2005).

A major policy for the NHS in England with the potential for a long-term effect on the impact of PbR on volumes of activity is practice based commissioning (PBC) (Department of Health, 2006). By encouraging demand management by GPs, i.e. closer consideration by them of the cost consequences of their referral decisions, this may serve to dampen hospital activity levels. Since April 2005, GP practices in England have had the right to hold an indicative PBC budget covering at a minimum:

- all hospital-based care covered by PbR;
- prescribing;
- community services;
- mental health services.

PCTs still retain statutory responsibility for the funds allocated to them, even though GP practices hold indicative PBC budgets. PCTs are required to allow GP practices that take on indicative PBC budgets to retain at least 70% of any savings against that budget “for reinvestment in patient care” even if the local health economy is in deficit. For the most part the impact of PBC is yet to be felt. Since the end of 2006 all 152 PCTs are reported to be putting in place the necessary arrangements to support PBC and, as at the end of 2006/07, 96% of practices have taken the incentive payments offered in the nGMS contract to start to engage in PBC (Department of Health, 2007a). A Department of Health press release on 26th January 2007 gives examples of “early adopters” of PBC reducing their referral rates to hospital since they became indicative budget holders (Department of Health, 2007b). But that aside it is very early days for PBC and reliable evaluation of its impact will only emerge over the coming years.

The English NHS has retained the separation between providers and purchasers/commissioners of care which was introduced throughout the UK in 1991 but revoked in Scotland in 2001. Thus in England 152 Primary Care Trusts (reduced from 304 until October 2006) are allocated budgets to buy care from provider Trusts and primary care contractors. The provider organisations include over 200 acute hospital Trusts. Many of the acute Trusts are based around general acute hospitals and provide a wide range of the services that are now paid for under PbR; but a minority are specialist Trusts supplying a narrow range of services such as elective orthopaedics, or heart and lung treatment, or children’s services.

2.4 A Comparator – Hospital Financing in Scotland

Because part of our analysis draws on a comparison of quantitative data in England and Scotland, we highlight in the following paragraphs important differences between the structure and policy context of the NHS in England and the NHS in Scotland.

The Scottish health care system historically has had a different structure to that of England, reflecting its separate administration (and, since 1998, separate Government) from England and perhaps its population size and distribution (Ham, 1992).

Patient choice, Foundation Trusts and Practice based Commissioning have not been adopted in Scotland. Since devolution the Scottish Government has placed greater emphasis on central planning and has vertically reintegrated the commissioners and providers of the internal market. Unified NHS Boards were introduced in 2001 and by April 2004 NHS Trusts in Scotland ceased to exist. The structure of the NHS in Scotland has since remained stable⁷ (Jervis and Plowden, 2003).

Although, like England, Scotland has used waiting time targets to stimulate improved performance, the specifics of these targets in terms of the maximum number of months patients should wait and the rewards (and penalties) associated with meeting (or not meeting) these were different for England and Scotland (Scottish Executive Health Department, 2001, 2004). Generally, the regime in England is considered to be more ‘aggressive’ with tighter targets and stronger sanctions if these are not met (Propper *et al*, 2007).

In 2005/06 a ‘shadow’ national tariff was introduced in Scotland. This was limited to cross boundary flows between the 14 NHS Boards and to two specialties (Scottish Executive Health Department, 2005). Further, there were no changes in financial flows associated with these in 2005/06. As a result we are able to treat the financing of NHS Boards as unchanged during our period of study.

In international terms, there are considerable similarities between the Scottish and English health care systems. The two countries have essentially shared the same

⁷ The exception is the movement from 15 to 14 NHS Boards in 2006.

financing mechanisms and broad policy developments until The Scotland Act 1998. Both systems are predominantly funded through general taxation and provide services free at the point of consumption. They each use family doctors as gatekeepers to secondary care services. They also have the same nationally agreed (UK) contracts for consultants, nurses and GPs.

We have been able to identify ways in which the NHS in Scotland differs from and is similar to the NHS in England. In a natural experiment the ideal control group would be similar in all ways to the group subject to policy change. However, as explained earlier such situations are rare in public policy. However, the NHS in Scotland does provide a structure similar to English NHS and importantly one which has been relatively stable in its financing of hospitals at the time of the implementation of PbR. As a result, we consider the NHS in Scotland to provide a useful control in our analysis.

2.5 Objectives of PbR

The objectives and anticipated benefits of the introduction of PbR have been articulated in a range of policy documents. When seeking to distinguish policy objectives we have focussed on the early documentation. These identify a number of objectives which are usually explicit and occasionally implicit in those documents. A range of objectives are identifiable.

The key document introducing PbR policy was '*Reforming NHS Financial Flows*' (Department of Health, 2002a). This document identified three main reasons for introducing a standard price tariff are given (Page 13)

- To 'enable PCT commissioners to focus on the quality and volume of services provided'
- To 'incentivise NHS Trusts to manage costs efficiently'.
- To 'create greater transparency and planning certainty in the system.'

These objectives are developed further elsewhere in the document.

The intended direction of change for quality of care is clear in the documentation.

‘Patients can have confidence that new funding arrangements will sustain improving quality’ (Page 11).

This is expected to be achieved partly by shifting negotiating time away from price and freeing up time to focus on the quality of care and by giving PCTs better ‘levers’ to achieve service improvement in combination with Patient Choice. Under Patient Choice, patients are given the opportunity to

‘choose among providers on the basis of quality’ (page 25).

The complementary policy of increased patient choice was intended to produce more informed patients. But even in the absence of this reform, commissioners of care would be expected to choose between providers on the basis of quality, all else being equal, as in a system of nationally fixed prices.

PbR, as with many other casemix-based prospective payment systems is given the explicit incentive to increase efficiency in the provision of health care services. More specifically, with respect to the justification for a case mix based payment:

‘Case-based payment has led to increased use of day surgery and reductions in lengths of stay in hospital’. (Page13, Department of Health, 2002a).

With respect to the intended effect on volume, the direction of the incentives is less unambiguous, reflecting the sophistication of the new system. On the one hand the system is expected to control the volume of services:

‘Clearer arrangements for risk-sharing ... will incentivise PCTs to manage demand effectively’. (Page 11)

On the other hand, PbR is expected to:

‘Create direct incentives for increasing the volume of services where growth is needed in order to improve access’. (Page 12)

These objectives suggest perceived linkages between the adoption of PbR and changes in the attitudes and behaviour of decision makers and, thus, ultimately the performance of the hospital system in the NHS.

The remainder of our evaluation is based upon exploring the nature of these linkages. We do so first using the tools and concepts of economic theory (Chapter 3) and then empirically, using both qualitative (Chapter 4) and quantitative (Chapter 5) methods.

Chapter 3. The link between Payment by Results and outcomes – theoretical considerations

3.1 Background

As discussed in Chapter 2, PbR institutes a system where NHS hospitals in England are paid a fixed price for each patient they treat within an HRG. From the perspective of economic analysis this constitutes a specific form of contract and implies specific incentives. The purpose of this section is to briefly review the economic theory in relation to the incentives generated to providers of health care by such fixed price contracts, and to suggest a specific model (and extensions to it) that aid an understanding of the operation of PbR in practice.

There is a vast literature on contracting for health services and it is not the intention to attempt to review it here: the focus will be on key concepts. The approach we adopt follows that provided by Chalkley and Malcomson (2000).

From the perspective of economic theory there are many elements of health care that give rise to incentive issues. In particular asymmetric information, wherein the provider of a service knows much more about what is to be supplied than the purchaser, is a pervasive feature of health care. To a considerable degree the economics contracting literature has focused on how contracts can be used to regulate the potentially damaging (either to society or to the purchasers of health care) behaviour that can result when health care providers exploit their information advantage. Hence, the terminology that is used is often suggestive of improper behaviour by providers. In this section we follow that terminology but recognise that impropriety is a matter of perspective: complex institutions such as health care providers have obligations to many interest groups, for example, patients, their employees, the local community etc. Our discussion is concerned with how in balancing these obligations providers may in practice not fully reflect the concerns of the purchasers of health care.

Before outlining the main concepts and ideas from economic models it is important to consider specific institutional arrangements.

In the NHS the health services that we are concerned with in considering the impact of PbR are predominantly provided by NHS Trusts and purchased by Primary Care Trusts (PCTs). Whilst admitting the possibility of other organisations within the NHS in what follows we will simply abbreviate these and refer to hospitals and PCTs respectively. An important distinction in the NHS is between hospitals that have achieved Foundation Trust status and those that have not. This is important from the perspective of economic theory because it is usual to assume that decision-makers have discretion over the use of any residual funds that they generate – indeed such ownership over any surplus often defines the ownership of organisational unit for the purposes of economic analysis.

Whilst Foundation Trusts are able to control their surpluses, hospitals that do not have Foundation Trust status are not. A full consideration of the implications of these different organisational arrangements is beyond the scope of this Chapter but is nevertheless an important aspect of the operation of PbR. Consistent with existing economic theory we simply consider in what follows that surpluses are to some degree beneficial to the hospitals that generate them, perhaps through their ability to negotiate better arrangements with PCTs. Similarly we assume that deficits are generally to the detriment of the hospital even if they do not necessitate borrowing or, more drastically, insolvency of the hospital as an organisation.

We suggest that future work might be targeted at considering the implications of these different organisational arrangements and, in particular, of the existence of financial deficits or surpluses for hospital decisions. For the purposes of our empirical work it seems prudent to distinguish between Foundation Trusts and other providers and consider empirically whether there are significant differences between them.

3.2 Three aspects of PbR

Cost sensitivity

In most economic analyses of fixed price payment the comparator (either explicit or implicit) is defined as *cost reimbursement*. Under cost reimbursement the provider of a service can be viewed as in effect submitting a bill for the resources used in delivering services and having that bill paid. The arrangements in the NHS that PbR replaces were, as with any real-world health care payment system, more complex and less clear cut. As outlined in Chapter 2, a variety of contracts were used prior to PbR described variously as block contracts, fixed budgets, cost and volume contracts and sophisticated block contracts.

One key element of all of these arrangements was that they enabled hospitals to negotiate prices with PCTs that were responsive to local conditions. Thus in setting a hospital's budget, or agreeing its cost and volume contract, a PCT would take into account the *likely* expenditure of the hospital, allowing for expectations regarding local conditions in terms of patient case-mix, salaries and wages, costs of capital (depreciation) etc. For the purposes of drawing lessons from economic analysis this sensitivity of contract value to those factors that drive cost is important. It suggests that notwithstanding the institutional specific terminology that pre-PbR arrangements were sensitive to cost to the extent that a hospital might influence the amount it was paid, if not in the present accounting period then in future ones, by actions or omissions that increased cost.

The Department of Health explicitly recognised this feature of the NHS financing system when describing the anticipated impact of PbR, noting that the movement from what it termed 'local prices' to a national tariff would increase incentives to control costs. Further evidence of within period cost reimbursement in the NHS exists in the specific case of sophisticated block contracts. The arrangements often explicitly allowed hospitals to negotiate an increase in a given contractual price on account of increased costs, most usually on account of adverse case-mix.

In summary, it seems to us useful to consider the movement to PbR as a shift from a 'more or less' cost sensitive payment system to an absolutely cost insensitive one. As

usual, in economic analysis the implications can be understood by abstracting from the complex reality and considering the shift in its starkest terms as a move from cost reimbursement to fixed prices.

Volume sensitivity

As described above the arrangements in place prior to PbR were varied. Under some contracts hospitals were explicitly paid more for additional treatments under the terms of their cost and *volume* contracts. Under other arrangements – sophisticated block contracts – hospitals could negotiate for extra payments ex post on the basis of having delivered more treatments than anticipated at the time the contract was agreed. Some contracts – fixed budgets or ‘simple’ block contracts – if interpreted strictly made no provision for payments to vary with the number of patients treated.

Under PbR there is a pre-defined and certain link between extra patients treated and payment. Thus it seems reasonable to regard PbR as a more volume sensitive payment system.

Case mix sensitivity

A third key aspect of PbR is in making payment HRG dependent, where HRGs serve to categorise patients, and their treatments, into a large number of categories. As compared with the pre-PbR arrangements where PCTs often contracted for a range of services encompassing a great variety of medical conditions, diagnoses and treatments, often very broadly defined, this makes payment more sensitive to the specific medical conditions of the individuals being treated. Hence, along with reduced cost sensitivity and increased volume sensitivity PbR moves payment to increased case-mix sensitivity.

The plan of the remainder of this chapter is as follows. In Section 3.2 we outline a basic theoretical framework which is useful for considering the incentive implications of PbR. We consider separately the specific implications of cost, volume and case-mix sensitivity in section 3.3, 3.4 and 3.5 respectively.

3.3 The Basic Theoretical Framework - Quality and Cost of Care

In terms of economic analysis a contract for health care, such as the agreement to purchase health services at a fixed price as implied by PbR, signifies delegated decision making because there are potentially many aspects of the treatment to be delivered that the PCT would like to (but cannot) specify and delegates to the hospital. Hence, the economic actor performing the task (usually called the agent) is doing so on behalf of, or to the benefit of, another economic actor (usually called the principal) who is then going to reward them and we can invoke principal-agent models. In the context of health care the task is health care delivery and we can think of the principal as the PCT and the agent as the hospital. Different methods of reward imply potentially different incentives to perform the task.

Principal-agent analysis suggests two types of problems that may be encountered by the principal when trying to align incentives. The first problem is easy to grasp --- the task itself, or some aspects of it, may not be verifiable. This gives rise to what is termed a ‘moral hazard’ or ‘hidden action’ problem. The real-world analogue of this in the context of health care is a hospital that fails to control its costs or deliver an adequate quality of service to its patients --- neither cost control nor quality are verifiable aspects of health care delivery. Somewhat more subtle, is what is termed the hidden information problem. This arises when some uncertainty affects the performance of a task such that it would be desirable to condition payment on the resolution of that uncertainty. The most usually discussed manifestation of this in health care is variable case-mix. A hospital that receives a lot of difficult patients to treat will legitimately require a larger budget to treat them. But the precise complexity of treatments required (as distinct from delivered) is information that only the hospital knows. There may be undesirable incentives to either exaggerate the severity of case-mix or, when case mix can be affected by selecting which patients to treat, manipulate case-mix.

There is a degree of consensus that in delivering health care, providers have discretion that can impact upon either or both of the quality and cost of the care that is provided. In the economics literature it is traditional to think about there being two decisions

that providers make in respect of, first, quality of care, henceforth q , and, second, cost-reducing effort, henceforth e .

The first of these requires little comment save to say that, in practice, quality of health care is considered to be multi-faceted. The second decision captures the idea that in delivering health care there are things that can be done, or left undone, that impact upon cost without necessarily affecting quality. For example, medical supplies can be conserved or wasted. With two aspects to health care decisions, in the jargon of the literature, there is a multi-task principal agent problem. In what follows it is assumed that, whatever the means of payment, the hospital has to maintain quality of care above some minimum $\bar{q}$ and effort above zero.

The key issues can be understood by initially restricting attention to the problem of treating a single patient and assuming the two decisions combine to yield the hospital a payoff of $P - v(q, e) - c(q, e)$, where P is the payment that will be received from the purchaser. It is easiest to think about $c(\cdot)$ as constituting the observable monetary costs of carrying out treatment whilst $v(\cdot)$ might be comprised of other unobserved costs (or indeed benefits) expressed in monetary terms. With these interpretations it is natural to assume that $v_e > 0$ (effort is unpleasant to the provider), $c_e < 0$ (but works to reduce monetary costs) and $c_q, v_q > 0$ (quality is in all senses of the word costly to produce). Meanwhile the PCT can be initially assumed to have some intrinsic concern about quality of care, captured by a payoff function $b(q)$ and a dislike of paying captured by $-(1 + \alpha)P$ where α is some dis-benefit over and above the transfer to the provider that may reflect, for example, dead-weight welfare loss. In most of what follows it is assumed that the hospital can be viewed as maximising $P - v(q, e) - c(q, e)$.

3.4 The impact of cost sensitivity

The conceptual framework of section 3.3 helps in understanding the some of the incentive properties of different payment schemes and in particular of a transition to PbR.

As argued in Section 3.2 it is simplest to contrast PbR with an arrangement in which hospitals are simply reimbursed for their costs which can be captured by assuming that $P = (1 + m)c(\cdot)$. The 'mark-up' m is included to ensure that the hospital is compensated for their unobserved costs $v(\cdot)$. This captures in essence the pre-PbR arrangement under which hospitals are financed out of public funds according to a budget that is set to reflect their expected costs. Maximising surplus under this arrangement leads the hospital to want to set either $mc_e - v_e = 0$ or $e = 0$ and either $mc_q - v_q = 0$ or $q = \bar{q}$. Under PbR the payment P is just a fixed sum --- a price per patient treated, or prospective payment because it can be set in advance of treatment occurring. In this case the hospital will want to balance the benefits and costs of q and e on the margin which requires either $-v_e - c_e = 0$ or $e = 0$ and either $-c_q - v_q = 0$ or $q = \bar{q}$.

Comparing the two sets of surplus maximising conditions as between cost reimbursement and PbR is revealing. Under cost reimbursement, the fact that $c_e < 0$ leads to the conclusion that $e = 0$ and $q > \bar{q}$ whereas under PbR the fact that $c_q, v_q < 0$ leads to the conclusion that $e > 0$ and $q = \bar{q}$.

This simple framework suggests that, other things equal, the greater cost sensitivity aspect of PbR will increase incentives to control costs but may result in some economising on quality of care. Of course in practice many factors may serve to mitigate this latter effect. For example clinicians with a concern for their patients, would work to increase quality of care. Nevertheless a first key idea from the application of contracts and incentives to health care is that PbR arrangements provide incentives to keep costs down but may compromise incentives to provide high quality care and this guides both our subsequent qualitative and quantitative evaluation methodology. Other things equal we expect the introduction of PbR to be associated with greater cost control and reduced quality.

In respect of the latter it is notoriously difficult to establish reliable objective indicators of quality of care. In Chapter 5, we follow much of the economics literature and use length of stay (LOS) as one measure of the outcome of hospital choices. LOS

is generally regarded as well correlated with unit cost and as such will reflect both q and e . It is not obvious either whether greater lengths of stay are better or worse for patients or whether LOS is a better indicator of quality of care or effort and it is perhaps safest to regard it as simply indicative of unit costs. Other commonly adopted measures of the outcome of quality and effort choices are various measures of mortality rates and we also consider these in our empirical work in Chapter 5.

The implications of this approach may appear very obvious but they have been generalised to settings which are much more complex. The central idea is enduring - fixed prices for health care help contain costs - and a significant extension to this is the notion that fixed prices might be consistent with achieving a socially appropriate level of quality. This works by allowing for the fact that under fixed prices that pay a surplus over costs, providers have an incentive to attract more patients. Enhanced service quality is one way that they might endeavour to do that, so that high prices become a driver of quality when patient demand reflects quality. The analysis above can be modified to illustrate this idea by allowing for a probability that a patient will arrive to be treated and that this probability depends on quality, hence $p(q)$ multiplies the expression for the provider's objective. It is straightforward to show in this case that the condition for choosing a positive level of quality can be satisfied.

Provided that the fixed price is set so as to ensure that $P - v(q, e) - c(q, e) > 0$ (at the hospital's chosen levels of q and e) there is an incentive to treat all patients that come along as long as the hospital has the capacity to do that. In the next section we consider the implications of limited treatment capacity but here it is worth noting that the incentive to treat more patients is stronger the greater is the surplus over all costs implied by the fixed price. This suggests that any reduction in quality associated with the introduction of PbR will be greatest for those treatments where patients do not perceive quality of care or do not exercise choice in response to any perceived quality differences.

The theory set out above is generic in that the models have been developed to aid a general understanding of the impact of prospective payment fixed price contracts across a number of jurisdictions. The NHS constitutes a particular institutional setting, and PbR a particular implementation of fixed price contracting, and there are

additional concerns or questions that arise in the NHS. There are too many specifics to simultaneously incorporate into a fully articulated economic model. Indeed the return to constructing more tailored models is probably slight. The results (and thus questions) we have set out above are regarded as reasonably robust and they do not depend in any major way upon the choice of functional form or even specifically upon the assumed objectives of providers. More specialised models will, to a large extent, exhibit results that depend on a host of assumptions that it would be necessary to make in order to ensure that the model is tractable.

3.5 The impact of volume sensitivity

One particular feature of NHS health economies and the motivation for introducing PbR merits special attention. In most jurisdictions the introduction of fixed prices has occurred in circumstances where increasing the volume of health care activity has not a specific aim. In the NHS however there was concern that, at least for high-priority areas of health care, services should be expanded. Pre-existing arrangements for payment of hospitals made some provision for incentivising greater volume but as we have argued above it is reasonable to treat PbR as displaying greater volume sensitivity.

As we considered the issues as they pertain to the introduction of PbR in the NHS we could not find any existing analysis that appeared to capture the essential element of a capacity constrained health care system. Therefore, in this section we summarise some findings from a model that we developed to capture the idea that (in what has traditionally been a cash-limited system) there is a degree of fixed capacity and that the impact of this varies according to what kinds of treatments (distinguishing between elective versus emergency HRGs) a hospital is considering. We consider in such a setting the extent to which the greater volume sensitivity of payment under PbR might have an impact on the volume of different activities. In particular we take into account the fact that in practice PbR sets prices that reflect average costs.

Consideration of incentives in respect of how many patients to treat does not feature greatly in traditional economic models of fixed price prospective payment systems. From an economic perspective it is seemingly obvious that any payment system that

provides a surplus over marginal cost will provide an incentive to increase activity. In many jurisdictions with an element of private provision market, imperfections that give rise to excessive profits also generate strong incentives for investment in hospital capacity, and so it is implicitly assumed that prices that provide a margin over cost will provide an incentive to increased activity.

This idea of prices incentivising greater volume is clearly important in the context of the NHS where waiting lists persist and it is one reason why PbR has been advocated. It is tempting to conclude that PbR will incentivise activity across all HRGs because prices are being set to reflect average costs and since those average costs include an element of fixed cost recovery they will exceed marginal cost in most instances. Hence, it might be argued, hospitals will wish to treat additional patients because the benefit (price) will exceed the cost.

The formal model that we set out below demonstrates that the logic in the above statement is flawed and thus suggests a number of further questions regarding PbR and its impact upon volumes.

3.5.1 A model of volume choice in the presence of constraints

This section sets out a simple extension of existing theoretical models in order to articulate the impact of PbR in the context of capacity constraints and choices between supplying emergency or elective interventions.

The simplest case one in which the hospital faces, at least in the short run, a limitation on capacity. The simple case ignores quality issues. When quality of service impacts upon the likely demand for treatment, rational hospitals will wish to factor patients' likely demand responses into their price cost margin calculations. Other things equal this will increase the priority that hospitals place on HRGs where patients are responsive to quality and may, therefore, reduce activity where patients are not responsive.

The framework that we set out below is reasonably general and could be used to look at other issues -- such as the incentive to allocate resources as between emergency and elective HRGs, but we leave such extensions for future work.

We assume that the total costs that the hospital will incur in treating patients in two HRGs can be written,

$$C(x_1, x_2, q_1, q_2) = c_1(x_1, q_1) + c_2(x_2, q_2) + F, \quad (1)$$

where x_1, x_2 denote the numbers of patients treated, q_1, q_2 denote the qualities of service offered in each of HRGs 1 and 2 respectively and F is a fixed cost. The functions $c_1(\cdot), c_2(\cdot)$ are increasing in all arguments and convex. We assume that the hospital has a fixed capacity X to treat patients so that it is required to ensure that $x_1 + x_2 \leq X$.

For subsequent analysis, it is useful to consider the definition and practical measurement of average and marginal costs given $C(\cdot)$. The marginal cost of a

patient in HRG i is defined as $\frac{\partial C}{\partial x_i} \equiv \frac{\partial c_i}{\partial x_i}$ (which we abbreviate as c_{ix}) and will

depend upon both the number of patients treated in that HRG *and* the quality of service delivered i.e. q_i . Because the hospital produces more than one type of output, the definition of average cost is not so straightforward. On the assumption (embodied in (1) of separability of variable costs between HRGs, the *average variable cost* of HRG i is $c_i(x_i, q_i)/x_i$ and is a function of the number of patients treated in this HRG and the quality of service. A special case is where the function $c_i(\cdot)$ is linear in x_i -- here average variable cost equals marginal cost and is independent of the number of patients treated (but both average and marginal cost remain functions of quality). *Average total cost* cannot be defined without allocating the fixed cost, F , between HRGs. In preparation for PbR, hospitals have been required to produce such an allocation and there are a number of plausible candidates (allocating fixed costs according to the share in overall activity of each HRG; allocating fixed costs according to the share in total variable costs of each HRG; allocating fixed costs by reference to the value of central services that each speciality uses and distributing this

total to individual HRGs, and so on). Whatever the particular allocation of fixed costs chosen, it breaks the link between *average total* and *marginal* costs, so that even in the simplest case of linear functions $c_i(\cdot)$ there is no obvious relationship between average and marginal costs. The extent to which marginal and average costs will differ will depend on numbers treated, quality of service *and the specific convention used in allocating fixed costs*.

We consider a hospital that faces p_1 and p_2 for each patient that it treats in HRGs 1 and 2. Henceforth, if HRG i is a non-elective procedure⁸ we assume that the hospital faces a fixed demand D_i whilst if HRG i is an elective procedure the hospital faces a demand function $d_i(q_i)$ which is increasing in q_i . Finally, for the purpose of examining the impact of the introduction of PbR we assume that prices are set so as to be greater than marginal cost.

In the first instance, and for simplicity, we assume that the hospital is concerned with maximising the surplus of its revenue over costs and thus the programme of the hospital is,

$$\begin{aligned} & \max_{x_1, x_2, q_1, q_2} p_1 x_1 + p_2 x_2 - (c_1(x_1, q_1) + c_2(x_2, q_2) + F) \\ & \text{subject to} \\ & x_1 \leq d_1(q_1) \text{ (or } D_1), \\ & x_2 \leq d_2(q_2) \text{ (or } D_2), \\ & X \geq x_1 + x_2. \end{aligned}$$

It is perfectly possible to consider alternative specifications of objective for the hospital but the surplus maximising formulation used here suffices to establish the general point that choice of activity level under PbR depends in on the form of constraint that the hospital faces. Indeed, a large number of cases can be considered according to whether one or both HRGs are emergency or elective and according to

⁸Here, and henceforth, emergency denotes only that patients are not considered to respond to quality variations.

whether the demand and or capacity constraints bind. The essential flavour of the results can, however be understood by reference to a small number of special cases.

Case 1: Emergency HRGs and excess demand

If we assume that both HRGs are emergency and that the hospital faces excess demand in each HRG, it follows immediately that the hospital will wish to set the minimal quality of service that it can. This is simply a consequence of quality being costly and of there being no link between quality and revenue under our assumptions regarding emergency HRGs. Hence the hospital's programme simplifies to,

$$\begin{aligned} & \max_{x_1, x_2} p_1 x_1 + p_2 x_2 - (c_1(x_1, \bar{q}_1) + c_2(x_2, \bar{q}_2) + F) \\ & \text{subject to} \\ & X \geq x_1 + x_2, \end{aligned}$$

where $\bar{q}_1, \bar{q}_2$ denote the enforceable quality standards which are exogenous to the hospital. Using λ to denote the Lagrange multiplier, the first order conditions for this constrained optimization are either

$$\begin{aligned} p_1 - c_{1x} - \lambda &= 0 \\ p_2 - c_{2x} - \lambda &= 0 \\ X &= x_1 + x_2 \end{aligned}$$

or

$$\begin{aligned} p_1 - c_{1x} &= 0 \\ p_2 - c_{2x} &= 0, \end{aligned}$$

depending upon whether the capacity constraint is binding or not.

It is suggested by Newhouse (2004) that the US Medicare system, at least at its inception, was likely to be in the latter case, whereas there is some argument (the existence of waiting lists) for assuming that the NHS is in the former case. There is an important distinction between these two cases. In the capacity unconstrained setting, PbR would constitute an incentive to expand activity across all HRGs because whatever the allocation of fixed costs we might plausibly anticipate that prices (reflecting average cost) will exceed marginal costs (at least in the special case of linear variable cost functions). However, in the capacity constrained case, re-writing the equation above to eliminate the Lagrange multiplier yields

$$\frac{p_1 - c_{1x}}{p_2 - c_{2x}} = 1,$$

which indicates that hospitals will wish to equalise the margin of price over marginal cost across different HRGs. This suggests that PbR will give an incentive to *increase activity* in HRGs where the differential between price and marginal cost is initially high and *reduce activity* in those HRGs where the differential between price and marginal cost is initially low. As discussed above, since prices are set to reflect average costs, the incentive towards either increasing or decreasing activity is a function of the rule that was used by hospitals to allocate fixed costs. Suppose that for whatever reason the rule adopted tended to over allocate fixed costs to HRG 1, then by implication activity will be reduced in HRG 2 as a consequence.

This special case is potentially interesting but perhaps too simplistic. One expectation of the PbR system is that it will cause hospitals to wish to attract more patients through offering enhanced services. In such a setting it is not reasonable to treat quality as reduced to its minimum. In the simple framework described in this section we can understand the implications of variable quality by considering the case of elective HRGs.

Case 2: Elective HRGs and satisfied demand

In the case where both HRGs are elective and where the number of patients to treated equals the number presented for treatment (which we term *satisfied demand* in place of *excess demand*) the hospital's programme can be simplified by explicitly replacing numbers treated with demand and becomes,

$$\max_{x_1, x_2} p_1 x_1 + p_2 x_2 - (c_1(x_1, d_1^{-1}(x_1)) + c_2(x_2, d_2^{-1}(x_2)) + F)$$

subject to

$$X \geq x_1 + x_2.$$

where $d_i^{-1}(x_i)$ denotes the inverse of the function $d_i(q_i)$, which gives the quality of service that the hospital will have to provide in HRG i if it is to have x_i patients to treat. This programme is solved in terms of numbers treated and we have written the programme in this way even though it might seem more natural to write it as a choice of quality of service, in order to facilitate easier comparison with Case 1.

By analogy with the analysis for Case 1, there are two possible sets of conditions characterising the solution to this programme depending upon whether the capacity constraint is binding or not. These are,

$$\begin{aligned} p_1 - c_{1x} - c_{1q} d_{1x}^{-1} - \lambda &= 0 \\ p_2 - c_{2x} - c_{2q} d_{2x}^{-1} - \lambda &= 0 \\ X &= x_1 + x_2 \end{aligned}$$

or

$$\begin{aligned} p_1 - c_{1x} - c_{1q} d_{1x}^{-1} &= 0 \\ p_2 - c_{2x} - c_{2q} d_{2x}^{-1} &= 0, \end{aligned}$$

The point to note about these conditions is the addition of the terms relating to the derivatives of the inverse demand functions. They otherwise follow the conditions for Case 1. The implication of these additional terms is that besides being concerned about the margin of price over the marginal cost of treating an additional patient, the hospital is now concerned about the margin over that cost plus the marginal cost of the additional quality that will be required in order to attract that additional patient.

To understand the implication of these additional terms, it is instructive to consider some alternative possibilities. If patients are better informed regarding the quality of care on offer in HRG 1 than in HRG 2, they are likely to respond more vigorously to quality variations in that HRG, this implies that the derivative of $d_1(q_1)$ with respect to quality is likely to be larger than that for $d_2(q_2)$ and, thus, that the derivative of the inverse demand d_1^{-1} with respect to numbers treated is likely to be smaller than the corresponding derivative of d_2^{-1} . Other things equal, this suggests that PbR will give an incentive for hospitals *increase quality and activity in HRGs where patients are responsive to quality* and, at least where hospitals are capacity constrained, an incentive for hospitals to *reduce quality and activity in HRGs where patients are not responsive to quality*. Hence, we conclude that there is an incentive impact of PbR in elective HRGs that depends purely on patient's responsiveness to quality variation --- which may be quite different from an independent assessment of quality.

Case 3: A mixture of emergency and elective HRGs

We consider next the combination of HRG 1 being an emergency treatment for which there is excess demand and HRG 2 being an elective procedure, which the hospital

can regulate demand for through its choice of quality of service. The hospital's programme is now:

$$\max_{x_1, x_2} p_1 x_1 + p_2 x_2 - (c_1(x_1, \bar{q}_1) + c_2(x_2, d_2^{-1}(x_2)) + F)$$

subject to

$$X \geq x_1 + x_2.$$

The corresponding first order conditions are

$$p_1 - c_{1x} - \lambda = 0$$

$$p_2 - c_{2x} - c_{2q} d_{2x}^{-1} - \lambda = 0$$

$$X = x_1 + x_2$$

or

$$p_1 - c_{1x} = 0$$

$$p_2 - c_{2x} - c_{2q} d_{2x}^{-1} = 0.$$

Again the more interesting case is where the hospital is capacity constrained. The conditions combine to give a requirement that

$$\frac{p_1 - c_{1x}}{p_2 - c_{2x} - c_{2q} d_{2x}^{-1}} = 1.$$

Hence, consider the implications of consumers acquiring better information over time regarding the quality of care offered in different hospital and thus becoming more responsive to variations in demand. As discussed in Case 2, the implication of this is cause the hospital to wish to increase the number of treatments in HRG 2 (by increasing quality there) but to *reduce the number of patients treated in the emergency HRG 1*.

The interdependency of treatment numbers across HRGs is a key element in the analysis above. This combined with the fact the prices will be set to reflect average costs, which in turn will reflect a possibly arbitrary allocation of fixed costs to different HRGs, means that factors that impact on the incentives to increase or reduce treatment numbers in a single HRG will have effects across all HRGs. The cross-HRG incentive effect comes about in the framework above when an overall capacity constraint binds --- which seems a reasonable starting point for describing a rationed health care system which offers services that are free to users. However, it should be noted that binding capacity constraints are sufficient but not necessary for this cross-HRG effect. Any more general cost function that allows for the marginal cost of treating a patient (or improving quality) in one HRG to depend upon the number of patients treated (or the quality treatment) in other HRGs would have similar

implications. Given that production of hospital services is complex such interdependence would seem generic. A restriction to just 2 HRGs is not restrictive since the generalisation to many HRGs is obvious.

The presence of interdependency combined with prices that reflect average costs rather than health care priorities suggests that purchasers of health care services who wish to be pro-active in addressing health care concerns for their population will need to approach the adoption of PbR with both caution and sophistication.

The simplest case to consider and describe is one in which hospitals 'produce' many treatments (HRGs) and face, at least in the short run, a limitation on capacity. In such circumstances formal analysis suggests it is hard to avoid the conclusion that a hospital will wish to reduce low value activities (those where price-cost margins are comparatively small) in order to expand high value activities. The desire to maximise surplus will lead to a tendency to wish to equate price costs margins. When, as under PbR, prices are set to reflect average costs which include an allocation of fixed costs, and there is no obviously correct way to allocate such costs, there is little reason to suppose that the magnitude of price cost margins that will emerge under PbR will be equalised by expanding all areas of activity. From the hospital's perspective some volumes will need to increase but other may need to decrease.

This theoretical model can be generalised to consider the role of quality of care and its impact on demand. This adds another layer of complexity to the question of whether PbR will provide incentives to increase or reduce volumes because the definition of marginal cost needs to account for the quality of service that is necessary to sustain a given volume of activity. For some HRGs (such as emergency treatments) it is unlikely that this is a major consideration but for at least some elective procedures it might be very important.

We thus conclude that economic theory suggest that the impact of PbR upon treatment volumes across different HRGs is ambiguous and complex. Theory suggests that for some HRGs there may be an incentive to increase the number of patients treated, whereas for others there may be an incentive to reduce numbers.

3.6 Implications of increasing case-mix dependence

The basic framework of Section 3.2 can also be adapted to consider the role of greater case-mix sensitivity. Once again fundamental issues can best be understood by abstracting from the complexities of reality, where HRGs are used to separate previous contracts into many separate payments, and here consider the implications of separating the payment to a hospital into two HRGs (PbR) having started with a single payment (pre-PbR).

The approach to this issue suggested by economic theory is to start by assuming that the HRGs describe two different kinds of patients which for convenience we will distinguish simply in terms of their cost of treatment i.e. high cost and low cost.

If we in addition, and again for simplicity, drop any consideration of quality the expected (observable and unobserved) costs of treating, a randomly selected patient is $(\beta c^h(e) + (1 - \beta)c^l(e) + v(e))$ where β is the proportion of patients in the population that are the high cost type.

A first case to consider is where it is easy to distinguish between the two types of patient. In such a setting there appears initially little difference between paying the average price and separating out the price for high and low cost patients. Under both systems the payer will have to cover the expected cost. But this assumes that the hospital treats enough patients such that the average price covers its costs. If it is unlucky in having a disproportionate number of high cost patients it will incur a deficit and in order to prevent this the price may need to be set higher than $(\beta c^h(e) + (1 - \beta)c^l(e) + v(e))$. This suggests that one benefit of greater case-mix sensitivity is that it facilitates lower prices overall. Those lower prices have to be balanced against the greater complexity of payment and the necessity of determining a greater number of prices.

Economists have been particularly interested in the further issues that arise when the differences between high and low cost patients are not discernible to the purchaser. This gives rise to hidden information and can be reflected in the assumption that only the provider can determine whether a patient is going to be high or low cost.

Having a single price (PbR tariff) that covers the range of patients to be treated is still perfectly feasible, but unless the price is set high enough the provider might choose not to treat high cost patients at all. This is called dumping in the literature. Dumping may not actually mean forcing people away but it may entail trying to persuade them that they are better off seeking treatment elsewhere. Dumping can be avoided by setting a price $P^h = c^h(e) + v(e)$ and because this is a fixed price, there will be no problem in terms of incentives for cost reducing effort. However, the purchaser will be paying more than the actual costs that the provider incurs in treating patients - when n patients are treated the excess payment will be $n(1 - \beta)(c^h - c^l)$. This sum is a pure surplus for the provider.

This line of reasoning suggests that there may be a substantial benefit to greater case-mix sensitivity but unfortunately from the perspective of practicality designing an optimal payment system to account for hidden information is a complex task. Thus whilst the benefits of greater case-mix sensitivity are increased by hidden information so are the costs.

3.7 Summary - linking theory to qualitative and quantitative evaluations

Quantitative evaluation

The discussion in Sections 3.2 – 3.5 has suggested a number of implications, based on economic theory, of adopting PbR. In summary:

1. The reduced cost-sensitivity of payments implied by PbR *is likely* to be associated with incentives to reduce **unit costs**. These unit cost reductions may be **either** indicative of **efficiency** (increased cost reducing effort) or reduced quality of care (or both).
2. Reduced cost sensitivity *may* give rise to incentives to reduce **quality** of care.
3. The increased volume sensitivity of payments implied by PbR has *complex and ambiguous* effects upon incentives to increase or decrease **volume** /

activity. These effects depend upon the nature of treatments (emergency or elective) and on the presence (or absence) of capacity constraints.

4. The increased case-mix sensitivity of payments under PbR may impact upon the overall cost of service delivery but the effect is ambiguous – depending upon how large the incentive under 1. above is and how large the administrative costs of the PbR system.

Unit costs, quality and volume constitute potentially observable outcomes of health care decisions, the first of these be proxied by LOS. Thus the theoretical framework considered in this chapter provides a framework for considering the quantitative impact of PbR in practice. As always the link between theoretical concepts and observable analogues is not perfect. We do not actually measure or observe quality of care or even unit costs not at least in the sense that the theory defines them. Nevertheless implications 2, 3 and 4 can be assessed in the light of quantitative evaluation and the framework of this Chapter provides the conceptual basis for the quantitative investigation that is described fully in Chapter 5.

This chapter also provides a conceptual basis for future quantitative work. A full and detailed breakdown of the impact of PbR on an HRG-by-HRG basis is beyond the scope of the present evaluation. It is, nevertheless suggested to be an important element of a longer term evaluation because our theoretical framework suggests that effects upon volume may vary HRG by HRG and there are a potentially rich set of implications to be examined in this regard.

Possible future research would necessitate a consideration of the administrative costs of different payments systems and an evaluation of the overall cost implications of PbR. Given the time frame over which such overall costs might need to be measured, this endeavour would present many challenges in terms of controlling for other changes: controlling empirically for system change even over the short run is problematic as the material in Chapter 5 makes clear.

Qualitative evaluation

Economic analysis rests on many assumptions. Some of these are discussed explicitly but many are implicit. Thus almost all economic approaches presume that decision makers are rational and perceive the environment in which they operate correctly and that they have at their disposal the information necessary to make rational decision. Economic analysis also mostly assumes that the objectives of decision makers are exogenous to the system. Thus we have not considered the possibility that hospitals change their objectives upon the introduction of PbR.

In considering a specific economic model of PbR we have further assumed that the PbR as it is described in policy announcements is implemented as such: in particular we have assumed that prices under PbR will be fixed in advance and not subject to ex post negotiation.

There are further subtle assumptions that underpin analysis. Thus, for example, the formal models assume that decisions are made in respect of a single time period. That presumes that PbR is fully implemented at the time decisions are made and that decision makers are not concerned about future changes or policy -- in the presence of costs to changing their actions they may wish not to respond to perceived temporary incentives.

The above may be considered as the preconditions for an economic analysis to be valid and it is thus appropriate to consider the extent to which the economic framework rests upon secure foundations. But these are not issues that are amenable to a quantitative analysis, rather they are concerned with what economic agents think, what they perceive and whether the policy has been implemented as planned and on time. Thus, prior to subjecting the framework described in this chapter to quantitative examination, in the next Chapter we summarise a survey-based qualitative investigation that was designed to help place the theory described here in context and further guide our quantitative approach.

Chapter 4. Qualitative analysis of Payment by Results

As discussed in Chapters 2 and 3, PbR constitutes a policy which is intended, through a particular financing arrangement, to alter the decisions and outcomes of hospital based health care in the NHS. In Chapter 3 the rationale for expecting PbR to influence outcomes was set out in terms the impact of PbR on incentives. Economic models make assumptions regarding the perceptions of decision makers, their objectives, their understanding and beliefs about the payments system they are dealing with and so on. A pre-requisite for the theoretical framework to be valid is that the policy change is implemented as specified and that decision makers understand and can respond to that. Thus, this part of our evaluation is concerned with describing the implementation and perceptions of PbR as reported by the decision makers themselves using an analysis based upon interviews of decision makers in the NHS.

In the remainder of this chapter we first consider the objectives of the interviews and then outline the methods used and the development process for the interview schedules. We then present the results of the interview analysis and relate them to process of PbR implementation. We then draw on the analysis to revisit some issues first raised in Chapter 3 and to illuminate issues that are subject to quantitative analysis in Chapter 5.

4.1 Objectives

The qualitative analysis complements the quantitative analysis and has four objectives:

1. To develop an understanding of how the PbR policy is perceived in the NHS and whether those perceptions align with the assumptions of the theoretical analysis,
2. To assess how PbR is being implemented in practice and whether it generates the kinds of incentives that are suggested by the theoretical framework.

3. To identify perceived drivers of (and obstacles to) implementation, by drawing on the experiences of key stakeholders in the implementation and application of PbR policy.
4. To inform further development of the theoretical analysis of PbR and to support and aid the interpretation of the quantitative analysis.

To achieve these broad objectives each round of interviews had specific objectives relating to the developing policy and the adapting interests of the Advisory Group. These are detailed in the methods section below.

4.2 Methods

Data for the qualitative analysis were collected in three rounds of semi-structured interviews with key stakeholders in the NHS. Some of the same subject areas are examined in more than one round but each round had a different emphasis reflecting the embedding of the PbR in the NHS and the emerging findings in the quantitative empirical work. The first round of interviews focussed on objectives (1) and (2), the second on objectives (2) and (3), and the third round of interviews focussed on objectives (1) and (3).

The purpose of the programme of interviews was, in each round, to try to elicit a range of views existing among senior NHS staff – managers and clinicians, providers and commissioners of care – rather than to determine the number of times particular issues were raised by particular categories of interviewees in particular types of Trusts or PCTs.

During the preparation stage of each round of interviews, the scope of the questions and the categories of interviewees, were agreed with the DH advisory group for the project. Ethical approval for the full programme of interviews was obtained in Spring 2005, on the basis that all interviews would be confidential and the individuals and organisations contacted would be kept anonymous. In addition, the first round interview instruments were piloted with a range of senior NHS managers to test the practicality of the approach and the scope and format of questions to be adopted in all three rounds.

Details of the objectives, sample of interviewees, method and results of each round of interviews, are given in Appendix E. The following paragraphs provide an overview of the method, and of how and why the three rounds of interviews differed from one another and how they combine to cover the broad range of issues to be addressed.

4.2.1 1st round of interviews

For the first round of qualitative analysis, held during the summer of 2005, we sought a total of 27 interviews with Directors of Finance at provider Trusts ('First Wave' Foundation Trusts and non-Foundation Trusts), PCTs and Strategic Health Authorities (SHAs), Chief Executives at PCTs and SHAs, and Medical Directors at Trusts. We were able to obtain interviews with 19 such individuals in total including all of these categories and covering:

- provision of secondary and tertiary care;
- London, other urban areas and rural areas; and
- Trusts with significant non-PbR income.

The questions asked in the round 1 interviews sought views from both commissioner and provider perspectives on:

- experience of the implementation of PbR up to summer 2005;
- expectations and early experiences of PbR's likely impact on activity, efficiency and quality of care;
- impact of PbR on relationships between NHS organisations within local health economies; and
- overall attitudes towards the PbR policy.

The results of the first round of qualitative analysis were reported to the Department of Health in October 2005 (Farrar *et al*, 2005).

4.2.2 2nd round of interviews

The scope of the second round of interviews, to take place in 2006, was discussed and agreed with the Department of Health in December 2005 and early 2006. In particular it was agreed that it would be more useful to focus future interview rounds on particular issues of interest.

It was agreed to concentrate the second round of interviews on the effects of PbR on provider non-price competition and hence on the quality of care. Combined with patient choice, PbR was intended to facilitate and stimulate quality-based competition between providers and thereby yield improved quality. To avoid possible objection by some NHS interviewees to the notion that they might be involved in competition, with its implications of commercial practice that some in the NHS may consider to have no place in health care, the questions were phrased in terms of attempts (successful or otherwise) to expand or defend the scale and/or scope of activity at individual providers.

Directors of Finance at provider Trusts (Foundation and non-Foundation) and Directors of Commissioning at PCTs were asked about experience of the recent past and expectations for the immediate future. At the Department of Health's request, particular attention was given to investigating the position of specialist hospital Trusts. During summer 2006 a total of 28 interviews were sought and 18 were obtained, covering 4 specialist and 12 general acute Trusts plus 2 PCTs. The low PCT representation was not surprising, due to the major reorganisation of PCTs that took place in mid-2006, including a halving of their total number.

The results of the second round of qualitative analysis were reported to the Department of Health in autumn 2006. They are described in Appendix E to this report.

4.2.3 3rd round of interviews

In discussion with the Department of Health in early 2007, it was agreed to focus the third round of qualitative analysis, in May and June 2007, on:

- coding within Trusts – how it is being done, how it has progressed over time, any difficulties remaining to be resolved;

- use of PbR within Trusts to incentivise directorates and teams;
- revisiting some of the questions asked in the first round, concerning the impact of PbR on activity, efficiency, competition and quality, and on the local health economy overall. The aim of this part of the interviews was to see whether a different and/or more sophisticated response to the reforms was discernible.

As before, the organisations approached covered specialist and general Trusts, and the PCTs that commission care from them, in three types of geographic area: London, urban non-London, rural. We approached Directors of Finance, Clinical Directors and Coding Managers in provider Trusts, and Directors of Commissioning and leading practice-based commissioners (GPs) within PCTs. The response rate from Foundation Trusts was very good but from other non-Foundation Trusts and PCTs was very low. Consequently, the results of the third round of interviews, which are reported for the first time at Appendix E of this report, are best seen as representing the experience and views of NHS Foundation Trusts.

4.3 Understanding the process of PbR

4.3.1 Overview of PbR policy

When we undertook the first round of qualitative analysis, in the summer of 2005, ‘First Wave’ Foundation Trusts had a little over a year’s experience with PbR for most of their elective and non-elective activity. Non-Foundation Trusts had just a few months experience of PbR being applied to (much of) their elective inpatient and day case activity, although more than a year’s exposure to the knowledge that PbR would be applied to them and how that would be done. Given the newness of the policy, some tentativeness might have been expected in NHS managers’ attitudes towards it. Overall, we found evidence that attitudes range from support of the policy to resignation with it as another task to be got on with, but there was no outright opposition to the PbR policy. There were, however, numerous concerns with the details of the mechanics of PbR and of its implementation. The overriding sense was of coping with a new set of rules and processes.

By the time of our third round of interviews two years later, in early summer 2007, the attitude of coping had developed more into one of familiarity. PbR was accepted as a given fact of NHS life. No respondent expressed a desire to return to the previous system of sophisticated block contracting.

Guidance

There was a mixed response in 2005 to the Department of Health's role in providing guidance and help with implementing PbR, ranging from the very positive to the very negative. National guidance was generally found to be useful by respondents, though considered to be a little slow in emerging in some cases. A recurring suggestion at that point was that the Department of Health team responsible for implementing PbR had been too small for the scale of its task. PbR was also seen in the NHS as largely a finance management system, with little obvious medical input or relevance. Given the fundamental nature of the PbR reform, the (centrally determined) pace of its implementation was often, though not always, viewed as too fast by NHS managers.

Tariff

The national tariff for activity included within PbR has been a major focus of discussion within NHS circles. The tariff is complex, covering 550 HRGs for inpatient and day case activity with different elective and non-elective prices and per diem rates for long stayers, plus 39 outpatient specialties, and several different A&E attendance prices; all combined with Trust-specific market forces factors. Despite this complexity, a common view heard in the 2005 interviews was that the tariff required considerable improvement.

The tariff is based on estimates of national average costs of activity taken from the NHS Reference Costs for England. Some first round interviewees identified the quality of the cost data underlying the tariff as poor. Prior to the introduction of PbR, respondents thought that Reference Costs data were not greatly used by individual NHS organisations and that as a result they put correspondingly little effort into ensuring the accuracy of the recorded cost data. However, respondents expected the quality of the cost data to improve now that there was a stronger reason for Trusts to commit effort to do so.

A criticism heard several times in the 2005 interviews was that the HRGs and their prices presented in the tariff did not appear to correspond to the costs of what the Trusts' clinicians considered they were providing. Similar comments were heard again, though only from two respondents, during the second round of interviews, in 2006. The Version 4.0 HRGs upon which the tariff is expected to be based from 2009/10 onwards are more disaggregated (increasing the number of HRGs from around 700 to over 1000) and so may be expected to deal with at least some of such complaints. The scope for unbundling tariffs, which has been made more explicit since 2005 (Department of Health, 2005), may also help, as proposed by some round 1 interviewees.

The market forces factor came in for two broad criticisms during the 2005 interviews. First, some thought it exaggerated labour cost differences across England as a result of being based on private sector pay rates, whereas NHS pay rates are more uniform. Second, the magnitude of the Market Forces Factor for an individual Trust could vary significantly and unpredictably from year to year, making financial planning very difficult. These may be misunderstandings of how the Market Forces Factor is intended to work and its stability. However, what is important here are the respondents' perceptions and how that affects the way in which they respond to the tariff.

The lack of credibility, for some, of the tariff as not truly reflecting in their view the activity they were undertaking for patients, combined with fears about its volatility from year to year, were found to undermine its usefulness as a basis for planning service development (or disinvestment) decisions by Trusts.

A number of respondents in the first round of interviews suggested that an independent body, not the Department of Health, should set the tariff. Sir Ian Caruthers commissioned the Lawlor report (2006) into the process of setting the tariff in 2006/07. The subsequent governance arrangements for the tariff setting process may address some of the respondents' concerns here through the proposal of a more transparent and accountable delivery process.

http://www.dh.gov.uk/en/Policyandguidance/Organisationpolicy/Financeandplanning/NHSFinancialReforms/DH_072533.

Risk

Most respondents in 2005 spoke of dramatically increased financial risk being a consequence of the introduction of PbR. This applied to Trusts but especially to PCTs as their income is fixed. They expressed that did not have direct control of the volume of activity. Methods for managing the extra risk seem to revolve around codes of conduct agreed between Trusts and PCTs. We were given little evidence of the development of comprehensive systems to effectively manage risk. Examining this issue in isolation, Mannion and Street (2005) found evidence of several different systems being implemented in South Yorkshire but no overall strategy for the region. Such arrangements have since been supported by the publication of a code of conduct following a public consultation in 2005 (Department of Health, 2006).

Coding

We asked high level questions about experience of coding activity during the first (2005) round of interviews and then returned to the subject in more detail in the third (2007) round – see Appendix E. In 2005 we found that, although Trusts have been coding activity for many years, the introduction of PbR had made coding the focus of rather more attention by Trust management than previously. The same point was repeated by the coding managers we interviewed in 2007.

In the first round interviews we heard complaints that the quality of discharge summaries – the basic raw material from which clinical coders have to work – was sometimes poor and that more, senior, clinician attention to writing them was needed. We did not hear such complaints two years later.

PbR had led to increased staffing in all the five coding departments where we interviewed during round 3 of the qualitative analysis. Costs of coding had consequently increased since the introduction of PbR, but not dramatically. The average cost of coding per patient episode appears to be of the order of £3 currently, which implies that across England as a whole, clinical coding is costing hospital Trusts of the order of £45 million per year. (This excludes the costs of checking coding incurred by commissioners of care).

All five coding managers interviewed in 2007 reported that their staff were coding episodes more fully than pre-PbR; entering all relevant conditions and procedures rather than just the main ones. Only one of the coding managers reported – in our confidential interviews – being put under any pressure to adjust their coding practice in order to favour the Trust financially, and they said they had resisted that pressure. Another of the five said that in the rare cases of doubt about how to code they would err in favour of the Trust, and another did consider it possible that occasional “overcoding” might happen. All five referred to professional integrity among coders; a determination to keep to the rules and not to risk the reputation and credibility of their Trust’s coding of activity. Two of the Directors of Finance we interviewed also volunteered that it would be counterproductive to risk ‘gaming’ and as a result be thought of as untrustworthy.

External validation of activity data, principally by the PCTs who have to pay for the work they are invoiced by provider Trusts, remains patchy. From the 2007 round of interviews, external challenge to Trusts’ clinical coding seems rare. But validation of the administrative aspects of coding is common: e.g. is that patient a resident of the catchment area of the PCT being billed for their care, or on the list of the GP practice being charged for it against their practice-based-commissioning indicative budget. Administrative error rates of around 2-2.5% were reported by interviewees. This was activity whose existence and nature were not being disputed, merely who was responsible for paying for it.

As a result of an Audit Commission investigation in 2006, which found what they considered to be “a relatively high level of clinical coding error”, an external audit programme is being rolled out across the NHS in England from April 2007 (Audit Commission, 2006).

Using PbR within Trusts

PbR operates at the level of Trusts and PCTs. As part of the third (2007) round of qualitative analysis we sought information on the ways in which Trusts pass on the activity, efficiency and quality incentives potentially implied by PbR to the clinicians and others who actually see the patients. All the hospital Trusts where we interviewed have an organisation structure that includes a number of separate Clinical Directorates,

each with their own budgets. In all of the Foundation Trusts where we could obtain interviews these budgets include income and expenditure, so that the Directorate has a particular net expenditure/income target for the year. In the one non-Foundation Trust where we interviewed in 2007 the Directorates had budgets only for expenditure.

Where income is included in Directorates' budgets, this includes both PbR and non-PbR revenues. Each Directorate has a planned level of activity and corresponding planned income. If the Directorate's outturn activity and hence the revenue it earns the Trust, differ from plan then there is no automatic feed through of (all of) the resultant excess/shortfall from the Trust as a whole to the Directorate. But there is a presumption that a pre-set proportion of any surplus income may be retained and used within the financial year by the Directorate that generated the income.

One respondent described the system used in his trust. Surpluses/deficits are not allowed to be carried over by Directorates from one year to the next and the proportion of any surplus revenue in-year that a Directorate may be allowed to retain varied between Trusts from 40% to 70%. The interviewee explained that in each case the remaining money goes into a central pot held by the Trust as a whole. A surplus-earning Directorate will, however, not see any of the surplus it earns if the money is needed to offset deficits in other parts of the Trust. For this Trust, therefore, there is no automatic relationship between Directorate activity and income.

Within a Directorate there are numerous clinical teams at work. At no Trust where we interviewed were individual teams being promised a proportion of any extra income the Trust earns as a result of extra activity they do, to spend at their team's discretion. Thus we found no high powered financial incentives for clinical teams in Trusts to do more work under PbR. However, the majority of Finance and Clinical Directorate interviewees reported that PbR had contributed to a "more business like" attitude among consultants and other Trust staff, with greater recognition of the link between the work they do and the financial consequences for the Trust as a whole. This reinforces a similar attitudinal change reported in the earlier rounds of interviews.

4.3.2 Incentives and Disincentives

The measured impact of PbR in the period up to and including 2005/06 on activity levels, efficiency and quality of care, has been estimated quantitatively and is presented in later sections of this report. Those sections also refer to findings from the interview programme that concern PbR's impact on hospital activity, efficiency or quality. In addition, as part of our qualitative analysis, we also asked NHS managers about the incentives and disincentives PbR was creating for their organisations, including those whose effects (if any) would be hard to detect from the quantitative analyses we have undertaken. These (dis)incentives concern: the care setting; changing the mix of services provided; service developments; and patient selection.

Care setting and care pathways

Where such incentives and disincentives were discussed by interviewees, they concerned effects on willingness to change the pattern of care provision. In the first round of interviews (2005) and again in the third round (2007) we heard that while the design of the tariff encourages hospitals to treat patients on a day case basis rather than as inpatients (because the price is the same but day cases should cost provider Trusts less), the tariff discourages moving patients from a day case to an outpatient basis because the price per outpatient attendance is much lower than for a day case admission. Similarly, at two different Trusts in the third round of interviews we heard that creation of 'one-stop shops' for patient diagnosis and outpatient consultation was considered by the Trusts' managers to be disincentivised by the loss of tariff revenue consequent on reducing the number of outpatient attendances.

A general disincentive for hospital Trusts to move care settings out of hospital and nearer to patients' homes – because of the consequent cut in revenues – was also noted by a small number of interviewees. Although the corollary of this is that PCTs have a clear incentive under PbR to encourage such changes in care setting, it is usually the hospital Trust and not the PCT that employs the consultants who determine how and where patients receive specialist health care.

Inflexibility over the care setting is particularly a problem for chronic, as opposed to acute, care. One Medical Director we interviewed in 2005 described this potential

impact of PbR as “a retrograde step for chronic disease management”. However, such concerns as were expressed seemed to be over the potential for problems arising rather than the existence of problems already. Despite the confidential nature of the interviews, no-one expressed the view, or cited any examples, that patient care was being detrimentally affected by PbR in practice. Thus the first round of interviews revealed a small number of concerns about the potential for PbR to have an undesirable impact on long-term care pathways.

In the third round of interviews, two respondents identified the discouragement to innovation that PbR causes where that innovation leads to an increase in costs in any year, as the tariff price for the care will not vary according to whether or not the innovation is used. There is scope for Trusts to try and negotiate with PCTs extra payments to cover such extra costs but PCTs are not obliged to accede.

Service mix

It might be expected that provider Trusts would respond in some way to the price signals given by the national PbR tariff even if their overall capacity were constrained by difficulties in recruiting additional key staff or lags in investing in additional physical capacity (buildings, plant and equipment). Trusts might be expected to change the mix of services they provide with the limited resources they have available: expanding activity in areas where their costs would be furthest below the tariff price – i.e. where the financial surplus earned would be greatest – by switching resources out of activities where their costs most exceed the tariff price or where the surplus available is smaller. This incentive is discussed in the “Theoretical Framework” section of the report.

In the first round of interviews (2005) we heard fears, but no evidence, from one PCT manager that a local Foundation Trust might respond to the PbR in this way. No other interviewee suggested it would happen. By the third round of interviews (2007) there remained no Trust respondents who thought that their Trust had changed the mix of its services by switching resources from less- to more-financially advantageous areas of care. Reasons given in 2005 for this apparent lack of interest by Trusts in adjusting their service mix to improve their financial position in response to the tariff’s price signals included fears that prices were volatile and could change substantially from

year to year, and belief that the Trust's cost information was too unreliable as a basis for such decisions. Fears of price volatility were still being raised by interviewees as a deterrent in the third (2007) round.

Service developments

The overriding response in the first interview round was that service developments would only be considered by Trusts after discussion with the main PCT(s) affected. Unilateral action by Trusts, even Foundation Trusts, was not generally expected. But we heard from both PCT and provider Trust sides the belief that PbR made it simpler to build business cases for new or expanded services, or for withdrawing patients from existing services, because the revenue or expenditure-saving consequences of doing so have become clearer, rather than being a matter for negotiation between PCTs and Trusts.

The lack of action on service developments may partly be explained, as for the case of changes to service mix, by fears that PbR tariff prices will change significantly in future, reinforced by a feeling that the prices seem divorced from the costs of any individual Trust's actual costs for a particular activity. Unwillingness, on these grounds, to make costly decisions on the basis of tariff prices was revealed in all three rounds of interviews.

Relationships within local health economies

The prevailing attitude evident in 2005 and still apparent in 2007, shared by Trusts and PCTs, was to maintain good relationships between providers and commissioners, and recognise the implications of the finite nature of PCT resources. "We are all in this together" was a common attitude. Bankruptcy of any party was deemed pointless and something to be avoided to the extent that the prospect of bankruptcy for any party was seen by other organisations as a constraint on their own actions. The constraint on increasing activity that is imposed by limits in PCT funding was still being highlighted by provider Trusts in the 2007 interviews. The view which could be summarised as "there is no point bankrupting the local PCT" was still heard, although there were greater signs than previously of one or two Trusts taking the initiative to expand the scope of their services.

Patient selection

In 2005 we obtained a mixed response to questions of whether Trusts would focus on lower cost patients within HRGs and try to avoid the more complex/costly cases. One respondent considered such behaviour to be “counter-cultural” in the NHS, but another thought their Trust might withdraw from complex joint-replacement revisions if PCTs would not provide additional funding above the tariff price to cover the extra costs of such cases. No patient selection was identified by any respondent as taking place in practice.

4.3.3 Competition

We focused the second round of interviews, in 2006, specifically on whether managers at Trusts and PCTs saw PbR as having influenced the degree of competition among NHS providers and between NHS Trusts and independent sector providers. We also asked more general questions in the 2005 and 2007 interview rounds about experience and expectations of competition.

Prices are fixed. Hence policy makers had hoped to stimulate non-price competition on the basis of service quality, given the scope for patient and referrer choice to result in higher quality providers being able to attract more patients and so earn higher revenues:

“We envisage that introducing a national tariff, which fixes prices for services, should enable commissioners and providers to focus more sharply on quality instead of time-consuming negotiations about price. This in turn should allow providers to compete on the basis of quality to patients, which should have the effect of improving quality of services across the system.” [Paragraph 51 of: Department of Health (2003) ‘Response to Reforming NHS Financial Flows’ Department of Health: London; available at: http://www.dh.gov.uk/en/Consultations/Responsestoconsultations/DH_4017035]

In the 2005 interviews we found little expectation of PbR stimulating greater competition between providers. Cooperation was emphasised by most respondents,

rather than competition. We found much the same in 2006, when just four out of 18 respondents identified active competition taking place for any of the services they provide. An urban Foundation Trust and nearby PCT both identified active competition generally in their locality; two other Foundation Trusts, one urban and one rural, highlighted small numbers of specialised tertiary services for which they felt they were actively competing with other NHS providers. However, no interviewee mentioned any particular efforts by their Trusts to improve service quality so as to attract more patients and hence revenue, although a small number referred to efforts to reduce waiting times in order to defend existing services.

A number of reasons were offered by respondents in our 2006 qualitative analysis for a lack of interest in competition. These confirmed the rationales put forward by respondents the previous year. Four sets of reasons were each mentioned several times:

- planning – half of all respondents, from a wide mix of organisation types, stated that service changes had to be planned together with local PCTs;
- constrained demand – local PCTs were in some places seen as having insufficient financial flexibility to pay for more PbR activity even if it were done, combined with a wish by providers not to “bankrupt” PCTs;
- geography – large distances between NHS hospitals was cited by all the non-specialised rural Trusts, but by none of the urban Trusts, as a factor limiting or preventing competition for secondary (i.e. not tertiary) services. A rural, specialised Trust cited geography as preventing it from competing for routine secondary work, but none of the specialised Trusts gave geography as a limit to competing for tertiary work;
- local NHS providers are at full capacity or there is excess demand – was given as a reason a few times.

Other barriers to competition between NHS hospital Trusts were also mentioned in one or two interviews in each case:

- PbR tariff unstable – two respondents stated that their (urban, non-Foundation) Trusts would not base investment or disinvestment decisions on the tariff alone, relative to costs, as prices might change unpredictably in future;
- risk aversion – two other interviewees, from urban Trusts (one Foundation, one non-Foundation) considered that their Trust would not invest in increased capacity in order to take on more work, because of the risk that the extra investment costs (capital and staff) would not be justified by the additional amount of activity that materialised;
- unassailable reputation – respondents from two urban non-Foundation Trusts (one of them specialised) and from a PCT local to the non-specialised Trust stated that the local reputation of their hospitals and consultants was so high that patients chose to come to them without any need for the Trusts actively to compete to win work;
- “the Department of Health does not want to let the market rip” – The Director of Finance of an urban Foundation Trust stated that they did not believe that the Department of Health wanted them to compete aggressively and that they would be penalised if they did.

In the third round of interviews we were told for the first time of a clear example (but only the one example) of quality-based competition stimulated by PbR. A Foundation Trust had employed two specialist back surgeons with the intention of substantially increasing their share of the regional market for back surgery, in which currently much of the work is undertaken by non-specialist surgeons in a number of other hospitals. The pitch to referring clinicians was thus along the lines: “send your patients to a specialist, not a generalist”. Much more common, however, was a continuing view that competition between NHS hospital Trusts was not particularly active or large scale.

In all three rounds of interviews, the response of NHS managers to the issue of competition between NHS Trusts and independent sector providers of hospital care was that it did not occupy a great deal of their thoughts or time. To the extent that independent sector competition existed the general NHS view was that independent

providers were specially favoured to such an extent that competition with them could not be on a fair basis. The reasons cited for this perception of unfair competition were:

- cherry picking – the independent sector is able to cream off the easier cases within an HRG, leaving more costly to treat patients for the NHS;
- higher prices – independent providers are paid at above-tariff rates;
- take-or-pay contracts – PCTs are forced to pay for activity contracted from independent sector treatment centres regardless of the number of patients actually treated;
- no disruption from emergency caseload as independent providers treat only elective patients;
- teaching and training costs – are borne by NHS Trusts but not by independent providers.

4.4 Perceptions, implementation and the outcomes of PbR

The above section illustrates with examples how the cultural and market characteristics of the NHS in England and technical aspects of PbR are shaping the response of some of the key stakeholders to the introduction of the new financing arrangements. Throughout, respondents make reference to a lack of certainty about the pricing system and how prices might change in the medium and a lack of information about their own Trusts cost structures. In addition, although the Trusts do not explicitly discuss their objectives (and neither would we expect them to), there is a concern for the broader local health economy. The PCTs appear to have limited capacity to address issues around demand management and some provider Trusts report that they experience both capital and labour constraints in their decision-making. These characteristics are likely to affect the key stakeholders' ability and motivation to respond to the incentives provided by PbR.

Nevertheless there would to appear to be an increasing understanding of the nature of PbR as an incentive mechanism and an acceptance that it is an established part of policy. Thus, in terms of the economic framework discussed in Chapter 3, the preconditions for PbR to be able to affect outcomes through incentives appear to be firmly in place.

In Chapter 3 we identified predictions on the basis of economic theory concerning unit costs, volume of activity and quality of care. These outcomes are the subject of our extensive quantitative analysis in Chapter 5. We conclude this chapter by reviewing what respondents thought about the link between PbR and outcomes.

4.4.1 Cost Efficiency

Our economic framework identifies reductions in unit costs as one potential effect of PbR. One mechanism for lowering cost is greater efficiency, a term which is common in discussions about health care delivery. One of the policy intentions behind PbR was to reward efficiency (Department of Health (2002) 'Reforming NHS Financial Flows: Payment by Results'. Department of Health: London – see for example paragraph 3 of the Executive Summary). The idea that the NHS in England was 'already efficient' was made several times in each round of the qualitative analysis we undertook (see Appendix E) suggesting that our subjects did not expect to see further cost reductions, at least not through efficiency savings, as a consequence of PbR.

Indeed on the basis of the responses of those interviewees, it might be expected that PbR would not change incentives relative to those that already existed: principally through the elective waiting time targets – mentioned frequently by interviewees – and the penalties for failure to achieve financial break-even.

4.4.2 Activity and volumes

We asked interviewees in all three rounds of qualitative analysis about their perceptions of whether and how PbR was affecting the volume of activity undertaken in their local health economies. Most respondents identified increases in activity but were inclined to attribute this to continuations of past trends and to the pressure to reduce waiting times for elective care. A few respondents took the view that, because in their case the hospital's capacity was already fully used or the ability of local PCTs to pay for more work did not exist, they were trying to discourage rather than encourage increased activity. Trusts and PCTs were discussing demand management tools in some areas.

Overall there was little reporting of providers seeking unilaterally to boost their activity in order to increase their PbR revenues.

4.4.3 Quality of care

When we first interviewed NHS managers, in summer 2005, their expectations with respect to the impact of PbR on the quality of patient care were quite varied. Some feared PbR might damage patient quality, or at least deter improvements, in some places because of the need to keep costs below the nationally fixed tariff level. One interviewee feared that because the PbR tariff is based on national average costs it would produce “average quality services”. Others expected no impact on quality. But none considered that PbR was at that early stage stimulating Trusts to compete on quality. This view continued to predominate during our 2006 round of interviews.

We repeated our questions, although to a different set of interviewees, about the impact of PbR on quality when we undertook the third round of qualitative analysis in 2007. We asked Trust and PCT managers, including clinicians, whether PbR appeared to be affecting quality in either direction. No one thought that PbR was having an *overall* impact on quality in either direction, but we did hear occasional individual examples of both kinds of impact: quality improvements and quality reductions.

One Foundation Trust had employed two specialist back surgeons in the hope of increasing their share of the regional market for back surgery, in which much of the work was being undertaken by non-specialist surgeons in other hospitals. The pitch to referring clinicians was thus to: “send your patients to a specialist, not a generalist”. This was a recent innovation and it was not yet clear how successful it would be.

In the other direction, we were told by the Commissioning Director and a practice based commissioning GP at one PCT of an acute hospital that had been using specialist nurses to provide some diabetes, respiratory and TB care services in the A&E department but that the PbR payments for A&E attendances were insufficient to cover the costs, so the specialist nurses were being withdrawn.

In summary, our interviewees were broadly sceptical that PbR would have real effects of the kind hoped for by policy-makers or predicted by economic analysis. Whether

their scepticism is justified can be assessed in the light of the quantitative analysis that we report in the next chapter.

Chapter 5. Quantitative analysis of Payment by Results

In this chapter we present the quantitative analyses. We begin with the objectives and a summary of international evidence followed by a description of the analytical method. We then present the results of this extensive econometric analysis in five sections. These are: the results on the admissions data relating to efficiency; the results on the admissions data relating to volume changes, the results on the admissions data relating to the quality of care; the results on outpatients data relating to changes in volume and; the results on specific HRGs relating to volumes, casemix and coding.

5.1 Objectives

The objective of the quantitative analysis is to estimate the effects of the introduction of PbR on key outcome measures that relate to the policy objectives and test the expected effects identified in Chapter 3, section 3.7. To this end, we use the most appropriate outcome measures and an analytical framework appropriate for policy evaluation.

In this section we outline our choice of variables and explain the analytical framework and econometric techniques employed.

5.2 International experience

There is an empirical literature on the effects of prospective case mix based payment systems on key outcome measures in the provision of health care services. These have been reviewed and summarised in a number of journals and books. The reader requiring a detailed account is directed to these⁹. The key messages from this literature and those from the limited empirical evaluation of PbR are summarised in this section.

⁹ See Sussex and Street (2005), Department of Health (2002) Annex 2, Chalkley and Malcomson (2000) and Donaldson and Gerard (2004) chapter 8.

An activity-based finance system using Diagnostic Related Groups was first developed in the US and used to pay hospitals as part of the publicly funded Medicare program in 1983 (Newhouse and Byrne, 1988). Since then more than twenty health care systems in Europe, Australia, Asia and Africa have adopted similar DRG based financing mechanisms (Roger-France, 2003).

The dominant motivation for adopting the system was to control costs and introduce incentives to increase efficiency though some systems were also targeting waiting times and in turn the volume of care (Kjerstad, 2003).

Unit cost reductions, as proxied by reduced length of stay, are a commonly observed effect of the systems and, on occasion, quite dramatic reductions have been observed, especially when examining the short run. However, some investigations of how those reductions in length of stay have been achieved have warned, and found evidence, of cost-shifting to other payers or parts of the health care system (Newhouse and Byrne, 1988). For instance, in Sweden a large reduction in average length of stay for orthopaedic patients was accompanied by the transfer of patients to long-term care settings (Mikkola *et al*, 2002).

The overall policy context has been found to be important in determining the effects of introducing case-mix-based activity funding. In particular, the existing remunerations system will determine the extent of slack in the system and hence the opportunities for increasing efficiency and the rigidity of budgetary caps will affect the overall impact on health care expenditure (Rae, 2005).

One of the concerns accompanying the introduction of activity-based funding for hospital services is whether the ways that hospitals attempt to reduce their unit costs will have an adverse effect on quality. Therefore, many studies have focussed on the effects of DRG funding on the quality of care (Rosenberg and Browne, 2001).

There is less agreement on the effects of DRG-based financing on the quality of care. A common theme within the literature is the inadequacy of using variables from administrative data as measures of quality. Despite this, and in the absence of other measures, the main outcomes used to measure changes in the quality of care are

mortality rates (before and after discharge) and readmission rates extracted from such routinely collected data. Less commonly, patient surveys have been used (Ljunggren and Sjoden, 2001). Evidence from the USA suggesting a negative impact on quality of care following the introduction of activity-based financing has not been reproduced for European countries adopting similar systems (Dismuke and Guimeraes, 2002). However, whether these findings reflect the effects of the policy, the role of context, or the inadequacy of the proxies for quality remains a debated issue.

Emerging evidence in England

There has been much commentary on the likely effects of the introduction of PbR in England (See, for instance, Dixon (2004), Street and Sawson (2004) and Appleby and Renu (2004)) and a limited amount of analysis based on empirical findings. These have examined the impact on demand management, administrative costs and “HRG drift”, waiting times and the process of implementation.

Mannion *et al* (2006) examined the use of demand management methods following the introduction of PbR and Patient Choice in South Yorkshire. They noted a rise in acute elective and non-elective activity though the methods did not allow them to attribute this to the introduction on PbR. The focus of the study drew on qualitative data to conclude that there was no regional strategy for demand management. A range of local initiatives for active demand management were identified and are being monitored for their effectiveness. In the same paper the authors report increased administrative costs associated with the new contracting process. Via interviews with provider Trusts and Primary Care Trusts they estimated an increase in administrative costs per organisation of £100,000 to £180,000 and £90,000 to £190,000, respectively.

Appleby *et al* (2005) used data from the first year of implementation of PbR (2003/04) to examine whether there were increases in activity and associated reductions in waiting times in the 15 HRGs subject to tariff. They also hypothesised that low cost providers are more likely to respond to the incentive to increase activity. They found that while there were increases in admissions in some of the 15 HRGs, others experienced a fall; there was no association between waiting times and the use of the tariff; and provider costs did not appear to affect their response to the incentives. They did, however, attribute an increase in day case activity to the introduction of the

tariff. They point out in their paper a number of likely reasons for a lack of association in most of their analysis: the small proportion of hospitals' income affected by tariffing the 15 HRGs at the margin; the effects of waiting time targets 'swamping' the PbR effects; and the lack of information on their own costs and appropriate response to the financial incentives by the Trusts in this first year of the tariff.

The Audit Commission (2005) drew mainly on qualitative analysis through interviews with some additional basic analysis of 2004/05 activity data. Their three main findings were that NHS organisations were broadly welcoming of the reforms, that the reforms exposed existing weaknesses in organisations and local health economies and that the costs of implementation were higher than expected (at around £100,000 per organisation), towards the lower end of the range reported by the respondents in the study by Mannion *et al* (2006). They examined trends in the length of stay and volumes of activity and found little impact other than a 'marginal improvement in length of stay'. However, they acknowledge that their methods make it difficult to attribute the changes that they observe to PbR.

None of these existing studies have been able to isolate the impact of PbR from other confounding causes of variation in health care outcomes. A key aspect of our approach is to use the phased introduction of PbR and the Scottish hospital system as controls for these other factors.

5.3 Key outcome measures

A range of outcome measures were chosen on two bases. First they were to relate to the policy objectives identified in the Department of Health policy documentation and technical guidelines. These related to the efficiency, volume and quality of care. Second, they should include outcome measures that have been used in the DRG evaluation literature to examine the experience of the introduction of similar policies in other health care systems. The OHE review confirmed that the three broad outcome measures (efficiency, volume and quality) were those most frequently analysed elsewhere. Accordingly, we use a range of variables available in administrative data sets.

5.3.1 Unit cost, length of stay (LOS) and incidence of day cases and outpatient measures of efficiency

As noted in Chapter 3, LOS is generally considered to be well correlated with unit costs and sensitive to changes in financing regimes (Donaldson *et al*, 2005). We note that caution is needed in attributing any reduction in LOS to efficiency because it may also be a reflection of reduced quality of care.

One limitation of using length of stay is that there may be unobservable differences in resource use that relate more to the intensity of resource use during a patient's stay rather than its length (Chalkley and Malcomson, 2000). We use length of stay because it allows us to control for variations in case-mix at patient level using Hospital Episode Statistics¹⁰. The main alternative (Reference Costs) is potentially subject to variations in accounting techniques and is not available on an individual spell basis.

In addition, we use the proportion of daycase activity as a measure of the unit cost of care provision in the sense that an increase in the proportion of day cases is analogous to reductions in LOS. This is also a measure of the change in the pattern of service provision.

For outpatient activity we use measures of 'did not attend' and the return rate ratio (the ratio of subsequent to first appointments) as measures of the efficiency of the organisation of outpatient services.

5.3.2 Volume of care

We measure volume as the number of spells of care. This is the unit of reimbursement under PbR.

We also use the change in the proportion of non-elective spells as a measure of a change in the pattern of service provision.

We undertake work on the volume of outpatient attendances using first attendances, all attendances and different sources of referral.

¹⁰ Detailed accounts of the derivation of all variables used in the analysis are given in Appendix A.

5.3.3 Quality of care

Finding an appropriate and sensitive measure of quality of care is a continual challenge both for those wishing to regulate the supply of healthcare (Goddard *et al*, 2000) and for those attempting to evaluate the effects of policy on quality of care (Chalkley and Malcomson, 2000). In the absence of direct measures of quality of care, proxy measures are used. Two measures are most commonly used in hospital financing research: mortality and readmissions.

We use two measures of mortality: in-hospital mortality, measured by proportion of patients discharged as dead; and 30-day surgical mortality, measured by the proportion of patients recorded as dying during the 30 days following a surgical procedure in hospital. We anticipate that the 30-day mortality variable will be the most robust: the level of in-hospital mortality can be affected by changes in the length of stay which influences where a person dies rather than the quality of care they receive.

We measure readmissions using the proportion of patients with an emergency admission following treatment for hip fracture. This is an outcome measure that has been used by regulatory bodies in the performance assessment of health care providers (NHS Executive, 1998, Healthcare Commission, 2004, 2005). We use the definition 'Emergency readmissions to hospital within 28 days of discharge, as a percentage of live discharges' (Department of Health, 2002d). The rate of hospital readmissions has been criticised as a measure of quality because a hospital finance regime may provide incentives for providers of care to readmit patients and hence increase revenue (Kjerstad, 2003). Although inconvenient to the patient, this would not necessarily indicate that the first spell of care was of reduced quality. Furthermore, for some patients, part of their care plan is to be discharged followed by a planned readmission. Whilst we are unable to control fully for the potential for 'supplier-induced' readmissions, our use of emergency readmissions avoids counting planned readmissions.

In addition to creating variables as proxies of quality from our patient level dataset, we explored the possibility of using routinely collected provider-level information on the quality of care. Data on performance measures are collated by the Department of Health and Monitor as part of their monitoring and target setting activities. We chose five diverse measures of performance which we might expect Trusts to try to improve to attract patients. These were the rate of Methicillin Resistant Staphylococcus Aureus (MRSA) as a proportion of bed days, the proportion of cancelled operations, the number of emergency readmissions, hospital 30-day mortality following surgery and proportion of inpatients waiting less than 6 months.

Details of the construction and source of all variables are given in Appendix A.

5.4 Method

Our evaluation challenge is to measure the effect of the introduction of PbR on hospital behaviour. We seek to measure the effect of the policy on the targeted HRGs and Trusts. We require estimates of what would have happened if the tariff had not been introduced. We construct this control group using a ‘difference-in-difference’ framework (Blundell and Costa Dias, 2000). We compare the changes over time in the outcome variables for HRGs funded by tariff with the HRGs not funded by the tariff, before and after the tariff’s introduction.

This phased introduction of the policy represents a series of quasi-experiments. Since there are several difference-in-differences available, it is important to choose control groups that are most appropriate for the research questions being answered. If this were an experiment, we would be interested in the effect of PbR on each outcome, compared to a situation where PbR did not exist. This is the overall effect of PbR on the whole ‘population’ of hospitals in England. Other effects of the policy might also be of interest, such as the effect of PbR only for those hospitals where it was introduced, or only for FTs, or only for those HRGs to which it was applied. These are relevant in terms of the phasing in of PbR, and of the effects of PbR on particular sub-groups, but less interesting in answering the main policy question of the overall effect of PbR. In the face of these choices, we have used two criteria for selecting the counterfactuals.

1. *The control group remains the same the year after the comparison*

Work elsewhere (Croxson *et al*, 2001) has shown that providers of health care may exhibit some form of anticipatory behaviour prior to the introduction of a policy. Therefore, comparison with a group of HRGs that will become subject to the tariff in the following year will not be an appropriate representation of what would have occurred if the tariff had not been introduced. In general, it will underestimate the effect of PbR as its impact on this potential comparator group may have begun in the current year. Hence, to utilise the most robust difference in differences, where possible we use controls which are ‘un-tariffed’ in previous years and the following year.

2. *The tariff is applied in full not just at the margin.*

In the first two years of the introduction of PbR policy, the tariff was applied only to the subset of spells outside the Service Level Agreement (SLA) for small groups of HRGs. The Hospital Episode Statistics do not identify whether spells were provided outside the SLA. We anticipate that the effects of the tariff are weaker when applied only at the margin. Further, effects on these ‘marginal’ spells will be diluted when measured as part of all spells. Hence, we expect that the results of difference-in-differences that do not use these earliest applications of the tariff will provide a more robust estimate of the policy’s effects.

We used these two criteria to select the most robust difference in difference analysis. The opportunities for meeting both criteria lie with the later changes to policy, i.e. when the tariff is applied to all spells provided by FTs in 2004/5 and to all elective spells by NHS Trusts in 2005/6. For completeness, we also provide results of the analyses of the earlier marginal applications of the tariff in Appendix C, Tables C5 to C7.

The policy changes that we evaluate are:

- a) In 2004/5 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts. This included both elective and emergency spells.

We use this change in financing experienced by the FTs as the key to two DiD analyses which meet the two criteria specified above. For each of the dependent variables measuring volume, efficiency and quality of output we compare:

- (i) tariffed output by FTs with non-tariffed output in the same HRGs by non-FTs in England and
- (ii) tariffed output by FTs with non-tariffed output in the same HRGs by providers in Scotland.

We analyse changes between 2003/4 and 2004/5 to identify the effects in the first year of the policy change. We also analyse changes between 2003/4 and 2005/6 to identify longer-term effects for (ii).

b) In 2005/6 the tariff was applied to all (with some exceptions) elective spells but not to non-elective spells by Non-FTs.

We use this change in financing experienced by the non-FTs as the key to two DiD analyses which meet the two criteria specified above. For each of the dependent variables measuring volume, efficiency and quality of output we compare:

- (i) tariffed elective output by non-FTs with non-tariffed elective output in the same HRGs by providers in Scotland and
- (ii) tariffed elective output by non-FTs with non-tariffed non-elective output by non-FTs.

We analyse changes between 2004/5 and 2005/6 to identify the effects in the first year of the policy change.

We use the same DiD opportunities to analyse outpatients data and specific HRGs for evidence of changes in coding or treatment patterns.

5.5 Econometric analysis

The majority of our analyses are undertaken at spell level. More details of the econometric modelling for each variable are provided in Appendix B.

We use fixed effects to control for differences between the characteristics of HRGs and Trusts that are unobserved but remain constant over time. Examples of such Trust-level characteristics are management culture, teaching status, and local population characteristics. HRG-level unobserved factors include specialty-specific factors, patient demographics and case mix.

These unobserved factors are likely to vary both within Trust and within HRG. In addition, particular Trusts may be more efficient at providing particular HRGs and provide better outcomes and some HRGs will be highly specialised and will tend to be provided by particular types of Trusts both before and after the policy change. Thus we interact the two variables to create fixed effects for each combination of HRG and Trust. There are 81,820 fixed effects in total. Inclusion of these effects ensures that we model changes in efficiency and quality associated with PbR. Thus, we avoid the attribution to PbR of differences between Trusts that determined whether they received FT status. We also control for the characteristics of HRGs that determined whether they were deemed suitable for inclusion in PbR.

5.6 Results

The results are divided into three sections. The first section presents evidence of the effect that funding by tariff has had on unit costs by looking at trends in LOS and day case incidence. The second section presents findings on revenue-raising activities using changes in the volume of output and the proportion of non-elective admissions. The third section presents the effect on the quality of care, using data on in-hospital mortality, 30-day post surgical mortality and emergency readmissions for hip fracture.

We provide background context for the regression results by charting aggregate trends for the Trusts that become Foundation Trusts (henceforth ‘FTs’) and the Trusts that do not become FTs (henceforth ‘non-FTs’) by March 2006 and Scottish providers. Following this, we present the econometric difference-in-difference (DiD) results. We provide simple tables to illustrate the derivation of the DiD. The DiD values adjusted for Trust and HRG fixed effects are generated from the econometrics models

described in Appendix B. Trusts in a DiD analysis are defined as FTs or non-FTs according to their status in the final year of the specific DiD. Hence the results for FTs in the forthcoming tables will differ across tables which show DiD with different final years. At the end of each section we summarise the results and interpret our findings using evidence from both the structured interviews and the econometric analysis.

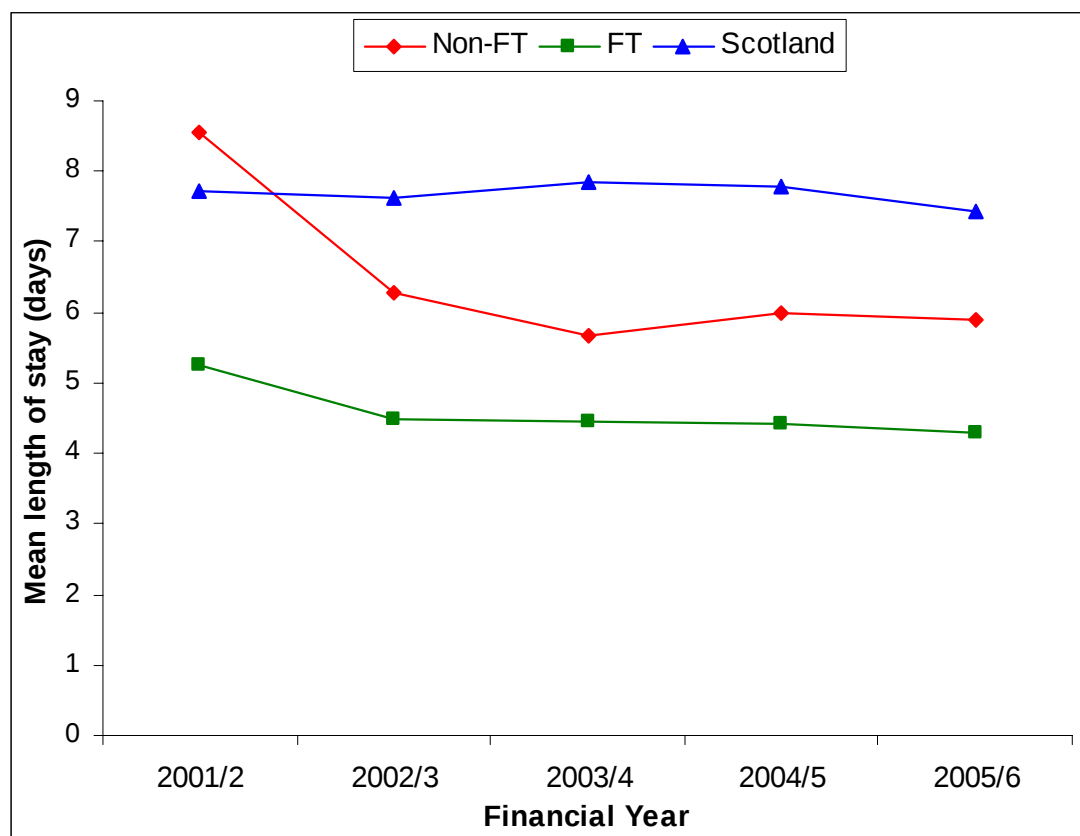
Within the main body of this report we have restricted the quantitative results to the changes in policy which took place in 2004/5 and 2005/6. These provide the most informative estimates of the effects of the policy. The results for the policy changes to the 15 HRGs and 33 HRGs in 2003/4 and 2004/5 are in Tables C5 to C10 in Appendix C.

5.7 Impact on unit costs

5.7.1 Length of Stay: general trends

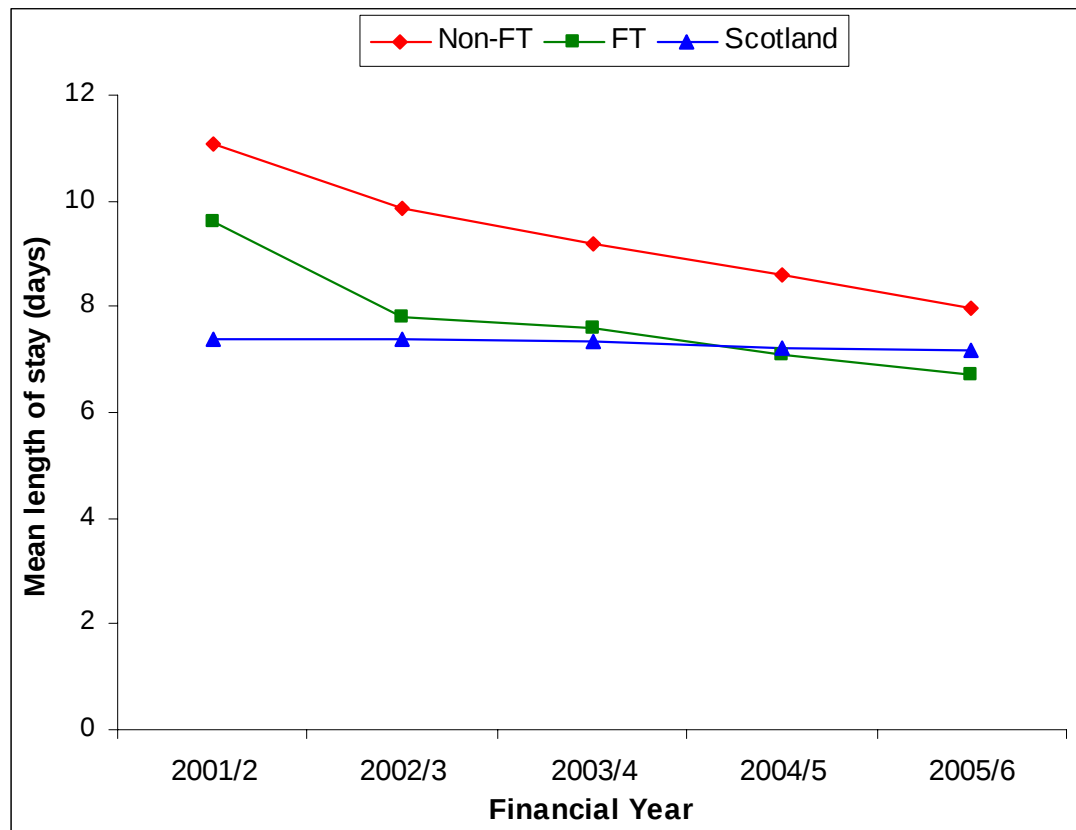
Figure 5.1 shows trends in mean length of stay (LOS) for elective spells for non-FTs, FTs and Scotland from 2001/2 to 2005/6. All Trusts in England have reduced LOS during this period. FTs started at a lower LOS and the absolute reductions have been smaller. Non-FTs have had steeper reductions in LOS each year with the exception of 2004/5 when LOS increased.

Figure 5.1 Trends in mean length of stay for elective spells in FTs, non-FTs and Scotland



The trend in mean LOS for non-elective spells has been downward for non-FTs and FTs over the period 2001/2 to 2005/6 (Figure 5.2). By comparison, Scotland has experienced a very small reduction. Mean LOS in Scotland is lower than both groups of English Trusts at the start of the period. By the end of the period, mean LOS in FTs is lower than in Scotland.

Figure 5.2 Trends in average length of stay for non-elective spells for Non-FTs, FTs and Scotland



5.7.2 Length of stay: difference in differences analysis

From the theoretical framework outlined in Chapter 3, we hypothesised that spells which are funded by tariff would have greater reductions in unit cost and hence mean length of stay. In this econometric analysis we model changes in the mean logged length of stay to reduce the influence of large outliers.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts. This included both elective and non-elective spells.

Table 5.1 shows the mean logged length of stay in FTs and Non-FTs in 2003/4 and 2004/5. The third column of figures is the change in the mean logged length of stay. On average, both types of Trust experienced a reduction in length of stay but, as the difference-in-difference calculation shows, this was greater in the Non-FTs than the FTs. This difference remains once we control for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs at baseline. The

difference in difference values are the difference in percentage changes in the mean length of stay. The results are counter to the hypothesis that the tariff would be associated with reductions in length of stay.

Table 5.1 FTs' DiD with Non-FTs in mean logged length of stay (days), 2003/4-2004/5

	2003/4	2004/5	Change in logged LOS	Difference in change in LOS
FTs	1.204	1.185	-0.019	
Non-FTs	1.213	1.187	-0.026	
Simple				+0.6%**
Adjusted				+0.5%**

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes elective 15 and 33 HRGs.

In Table 5.2 we employ Scotland as the counterfactual. Here the reduction in mean logged length of stay for the FTs is greater than for the providers in Scotland. This is indicated by the negative DiD value. After controlling for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs at baseline, the results show a reduction of 2.3 per cent in the average length of stay associated with the application of the tariff.

Table 5.2 FTs' DiD with Scotland in mean logged length of stay (days), 2003/4-2004/5

	2003/4	2004/5	Change in logged LOS	Difference in change in LOS
FTs	1.288	1.269	-0.019	
Scotland	1.300	1.302	+0.002	
Simple				-2.1%**
Adjusted				-2.3%**

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes 15 HRGs.

Table 5.2 shows the change in length of stay for the first two years of tariff for FTs and compares this with Scotland. FTs reduced length of stay more quickly. The DiD is statistically significant whether or not we control for changes in age-sex composition and differences between Trusts and HRGs.

Table 5.3 FTs' DiD with Scotland in mean logged length of stay (days), 2003/4-2005/6

	2003/4	2005/6	Change in logged LOS	Difference in change in LOS
FTs	1.294	1.257	-0.037	
Scotland	1.305	1.299	-0.006	
Difference in difference (simple)				-3.2%**
Difference in difference (adjusted)				-4.9%**

Notes: ** p<0.01. Excludes the elective 15 HRGs.

b) In 2005/6 the application of the tariff was extended to all (with some exceptions) elective output provided by Non-FTs.

Table 5.4 shows changes in the length of stay for elective output compared to non-elective output (which was not covered by the tariff for Non-FTs in 2004/5). The reduction was greatest in the non-elective output and this difference was statistically significant in the unadjusted model. Once we control for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs, the result is reversed: the negative and statistically significant DiD indicates that length of stay fell faster for electives than non-electives for Non-FTs in 2005/6. Given that only electives were being funded by the tariff this is what we would expect to see.

Table 5.4 Elective DiD with non-elective in mean logged length of stay (days) for Non-FTs, 2004/5-2005/6

	2004/5	2005/6	Change in logged LOS	Difference in change in LOS
Elective	0.944	0.919	-0.025	
Non-elective	1.401	1.368	-0.033	
Simple				+0.8%**
Adjusted				-0.7%**

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes 15 and 33 HRGs.

Table 5.5 shows a smaller, though insignificant, unadjusted reduction in mean length of stay for the Non-FTs in 2005/6 compared with Scotland. The DiD is negative and significant once we allow for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs in the first year, 2004/5. The results indicate that introduction of the tariff in 2005/6 for the Non-FTs was associated with reductions in mean length of stay of 1.2 per cent.

Table 5.5 Non-FTs' DiD with Scotland in elective mean logged length of stay (days), 2004/5-2005/6

	2004/5	2005/6	Change in logged LOS	Difference in change in LOS
Non-FTs	0.944	0.919	-0.025	
Scotland	1.371	1.338	-0.033	
Simple				+0.8% [‡]
Adjusted				-1.2% ^{**}

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes 15 and 33 HRGs.

We tested whether this change in length of stay of non-FTs differed by whether the non-FTs reported Reference Cost Indices above or below 100 in 2004/5¹¹. We label these 'high-cost' (>100) and 'low-cost' (<=100) Trusts. The results are shown in Table 5.6. The high-cost Trusts have significantly higher mean logged length of stay in 2004/5. Although the increase in length of stay was lower for the high-cost Trusts than for the low-cost Trusts, the difference is not statistically significant. The model that adjusts for changes in age-sex composition and Trust and HRG effects shows no significant difference between the high-cost and low-cost Trusts in the extent to which average length of stay was reduced.

Table 5.6 High-cost Non-FTs' DiD with low-cost Non-FTs elective mean logged length of stay (days), 2004/5-2005/6

	Difference in change in LOS, 2004/5-2005/6
Simple	-0.52% [‡]
Adjusted	-0.02% [‡]

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes 15 and 33 HRGs.

Table 5.7 shows non-FTs to have a reduction in length of stay in non-elective 2005/06 compared to an increase for Scotland. This difference remains once we have controlled for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs at baseline and is statistically significant. The results indicate that the introduction of the tariff in 2005/06 was associated with reductions in non-elective length of stay for non-FTs of 3.9 per cent.

¹¹ This analysis is restricted to non-FTs as this group of Trusts have sufficient variation in their reported Reference Cost Index.

Table 5.7 Non-FTs' DiD with Scotland in non-elective mean logged length of stay (days), 2004/5-2005/6

	2004/5	2005/6	Change in logged LOS	Difference in change in LOS
Non-FTs	1.401	1.368	-0.033	
Scotland	1.316	1.323	+0.007	
Simple				-4.0%**
Adjusted				-3.9%**

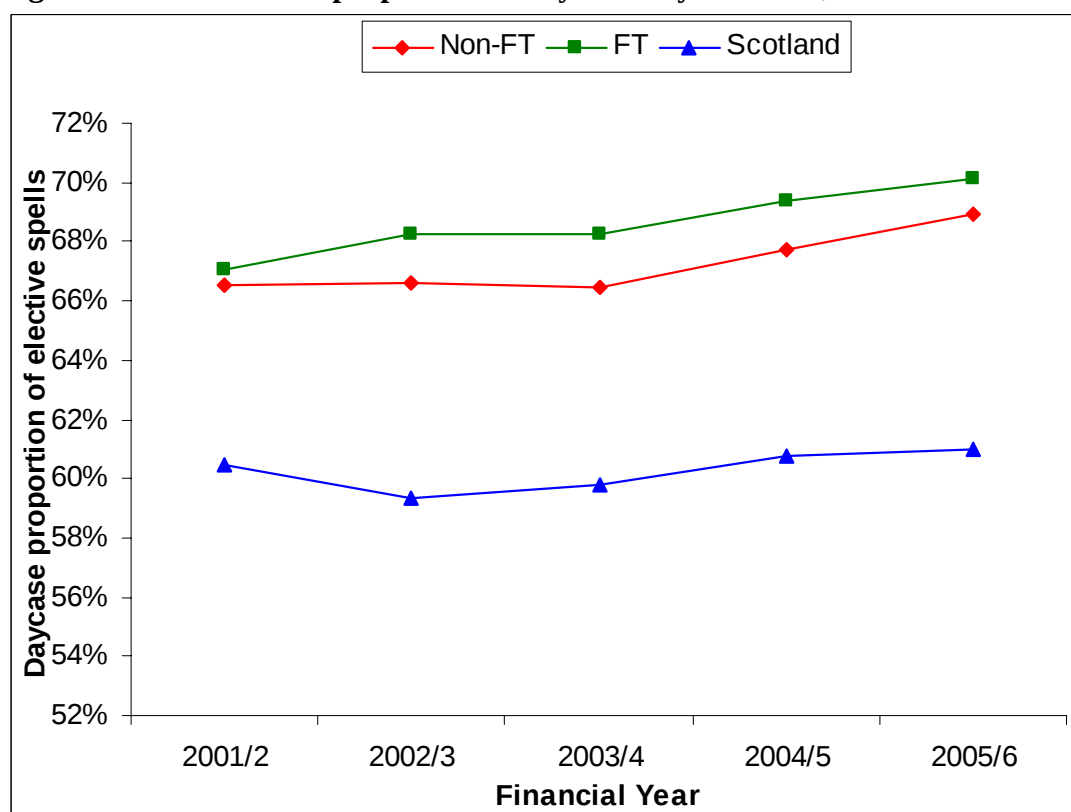
Notes: ** p<0.01. Excludes 15 and 33 HRGs

5.7.3 Day case rates: trends

Day case output by organisation

Throughout 2001/2 to 2005/6 the proportion of elective spells treated as daycases (the daycase proportion) was higher in England than Scotland. Between the beginning and end of the period the daycase proportion increased in all three types of organisation. The increases in the daycase proportion for non-FTs occurred in the last two years of the period. Increases were experienced in the first and the last two years in the FTs.

Figure 5.3 Trends in proportion of day cases by Non-FTs, FTs and Scotland



5.7.4 Day case rates: difference in differences analysis

The tariff for inpatient and daycase spells for a given HRG are the same. However, it is less costly for Trusts to provide care as a day case rather than keep a patient on the ward overnight. The equality of the reimbursement for day case and inpatient provision creates an incentive for Trusts to provide more day cases where possible and appropriate. This was an explicit objective of PbR policy.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts.

In 2004/5 both FTs and in Scotland experienced an increase in the day case rate. Using Scotland to represent the underlying trend, FTs had a larger increase in the proportion of daycase activity by 0.5 percentage points, shown in Table 5.8. Once we allow for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs in the first year, the difference remains statistically significant and is 0.4 percentage points. The results indicate that introduction of the tariff in 2004/05 for the FTs was associated with increases in the proportion of day case provision of 0.4 percentage points.

Table 5.8 FTs' DiD with Scotland in day case rates for all elective spells, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of daycases	Difference in change in proportion of daycases
FTs	68.9%	70.3%	+1.4 % points	
Scotland	61.1%	62.1%	+1.0 % points	
Simple				+0.5 % points**
Adjusted				+0.4 % points**

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes elective 15 HRGs.

Taking a two year view, Table 5.9 shows increases in day case rate for Scotland and FTs from 2003/4 to 2005/6. The statistically significant results indicate that FTs increased the day case rate more quickly over the period and that 1.5 percentage points of that increase were associated with the introduction of the tariff.

Table 5.9 FTs' DiD with Scotland in day case rates for all elective spells, 2003/4-2005/6

	2003/4	2005/6	Change in proportion of daycases	Difference in change in proportion of daycases
FTs	70.2%	72.1%	+1.9 % points	
Scotland	59.2%	60.0%	+0.8 % points	
Simple				+1.1 % points **
Adjusted				+1.5 % points **

Notes: ‡ not significant. ** p<0.01. Excludes elective 15 HRGs.

Table 5.10 shows the increase in daycase rates of FTs relative to non-FTs. Both types of Trusts experienced growth in day case rates in 2004/5 of 1.4 percentage points. Once we allow for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs in the first year, there is a difference of 0.4 percentage points which is statistically significant. The results indicate that introduction of the tariff in 2004/5 for the FTs was associated with increases in the day case rate.

Table 5.10 FTs' DiD with Non-FTs in day case rates for all elective spells, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of daycases	Difference in change in proportion of daycases
FTs	70.9%	72.3%	+1.4 % points	
Non-FTs	70.7%	72.1%	+1.4 % points	
Simple				+0.0 % points‡
Adjusted				+0.4 % points **

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes elective 15 and 33 HRGs.

b) In 2005/6 the application of the tariff was extended to all (with some exceptions) elective output provided by Non-FTs.

The day case rate for Non-FTs grew more quickly than for providers in Scotland in 2005/6. After controlling for changes in the age-sex composition of admitted patients and differences between Trusts and HRGs at baseline, the results show that growth in the day case rate was 0.8 percentage points higher in Non-FTs compared to hospitals in Scotland (Table 5.11). This higher growth in day care proportion for the Non-FTs

provides support for the hypothesis that Trusts will switch to day case provision to save costs under the tariff scheme.

Table 5.11 Non-FTs' DiD with Scotland in day case rates for all elective spells, 2004/5-2005/6

	2004/5	2005/6	Change in proportion of daycases	Difference in changes in proportion of daycases
Non-FTs	71.0%	72.1%	+1.1 % points	
Scotland	61.4%	61.6%	+0.2 % points	
Simple				+0.9 % points**
Adjusted				+0.8 % points**

Notes: ** p<0.01. Excludes elective 15 and 33 HRGs

Subgroup analysis

We tested whether this change in day case rate of non-FTs differed by whether the non-FTs reported Reference Cost Indices above or below 100 in 2004/5. As before, we label these 'high-cost' (>100) and 'low-cost' (<=100) Trusts. The results are shown in Table 5.12. The high-cost Trusts have significantly higher day case rate. The increase in day case rate was higher for high cost Trusts than for the low-cost Trusts and the difference is statistically significant. The model that adjusts for changes in age-sex composition and Trust and HRG effects shows that high-cost Trusts increased their day case rate by 0.25 percentage points more than low-cost Trusts in 2005/06.

Table 5.12 High-cost Non-FTs' DiD with low-cost Non-FTs for day case rates, 2004/5-2005/6

	Difference in changes in proportion of daycases
Simple	+0.22 % points**
Adjusted	+0.25 % points**

Notes: ** p<0.01. Excludes elective 15 and 33 HRGs.

5.7.5 Summary of effects on unit costs

We have examined whether Trusts reduced unit costs, by reducing mean length of stay or by increasing the proportion of elective spells treated as daycases, in response to the introduction of the tariff in 2004/5 and 2005/6. We undertook six main tests on mean LOS using non-FTs and Scotland as controls for FTs in 2004/5 and using Scotland as the control group for FTs and non-FTs in 2005/6. We undertook a further four tests of the effect on the proportion of day case activity. We also undertook

subgroup analysis to identify whether there were differences in changes in the unit costs (LOS and daycase proportion) of high cost and low cost Trusts. A summary of the results is presented in Table C1 of Appendix C.

Five out of the six tests on LOS, showed mean LOS to have fallen, compared with the control group. These results support the anticipated effects of the PbR policy that unit costs would be reduced as a result of the introduction of a fixed national tariff. This is in line with effects observed in other health care systems. Reductions in unit costs have been one of the most common findings of international research into the effects of fixed price payment systems. Our findings suggest that PbR represented a stronger incentive to unit cost reduction than those that existed within the financing system it replaced.

Our analysis shows an increase in daycase rates associated with the introduction of the tariff for all the tests undertaken. This result is consistent with the awareness we found among interviewees of the unambiguous financial benefits of switching from inpatient to daycase treatment. Increased daycase rates were stimulated by PbR among both FTs and non-FTs, despite their already high daycase rates relative to Scottish hospital trusts.

For the subgroup analysis, we found that high cost Trusts had higher increases in the growth of daycase rates. However, there was no association between Trusts' costs and the effect on mean LOS.

One test, however, gave results counter to expectations. When we compared LOS for FTs and non-FTs in 2004/5, we found that LOS fell more quickly for the non-FTs, during a period when very little of their income was generated through the tariff. The lack of support for the effect of tariff on length of stay in this test together with the positive tests when Scotland is used as the control group suggests that there may be other pressures on NHS Trusts in England to reduce unit costs. Reducing length of stay has been implicit in the use of financial targets as part of performance

management in the NHS in its various guises¹². (However it was not listed as a specific target during the period of our analysis). Another explanation for this exceptional finding could be that non-FTs in 2004/5 were working to reduce costs in preparation for the known extended use of tariff in 2005/6.

These results from the quantitative analysis suggesting that PbR is having a downward effect on unit costs may be seen as surprising for a number of reasons. Our qualitative research revealed a majority view among the NHS managers we interviewed that PbR was not adding significantly to the considerable incentives for efficiency that already existed in England pre-PbR. The payment mechanism is being applied within a health care system which has historically had fixed global budgets and has previously implemented policies to reduce unit costs and increase efficiency and meet financial targets in the form of nationally set performance indicators with explicit rewards and penalties. Therefore, there may be less scope for significant reductions in the unit costs of the provision of hospital care. Indeed drawing on the qualitative results of this project, some interview respondents suggested that they would be unable to cut unit costs in response to the tariff as there were no more opportunities for cost-saving within the system.

Further, the PbR tariff is set using mean average costs and so around half of providers will already have costs below the tariff. Although there is an incentive to keep prices below the tariff, for these lower cost providers the incentive to reduce unit costs further depends on the attractiveness of the arrangements for retaining surpluses or the need to subsidise and help retain loss-making services elsewhere in the Trust. We found evidence of such within-Trust cross-subsidisation from the interviews. In the quantitative analysis we found that high cost non-FTs increased the proportion of daycase activities more quickly than low cost non-FTs, but there was no difference between the two control groups for change in length of stay. In addition, during the period of phasing-in of the tariff, there are transition arrangements which protect Trusts that are above tariff from the full financial implications of any difference

¹² See CHI at <http://www.chi.nhs.uk/Ratings/> and Healthcare Commission at <http://2007ratings.healthcarecommission.org.uk/homepage.cfm>.

between pre-dating local prices and the national tariff price¹³. This temporary protection reduces the incentive to find cost savings.

Despite evidence from the interviews and factors in the design of the tariff which might be expected to temper its effects, we have observed reductions in unit costs in daycase and inpatient activity in 2004/5 and 2005/6 which can be associated with the introduction of the tariff-based financing system in England.

5.8 Effects on volume and pattern of care

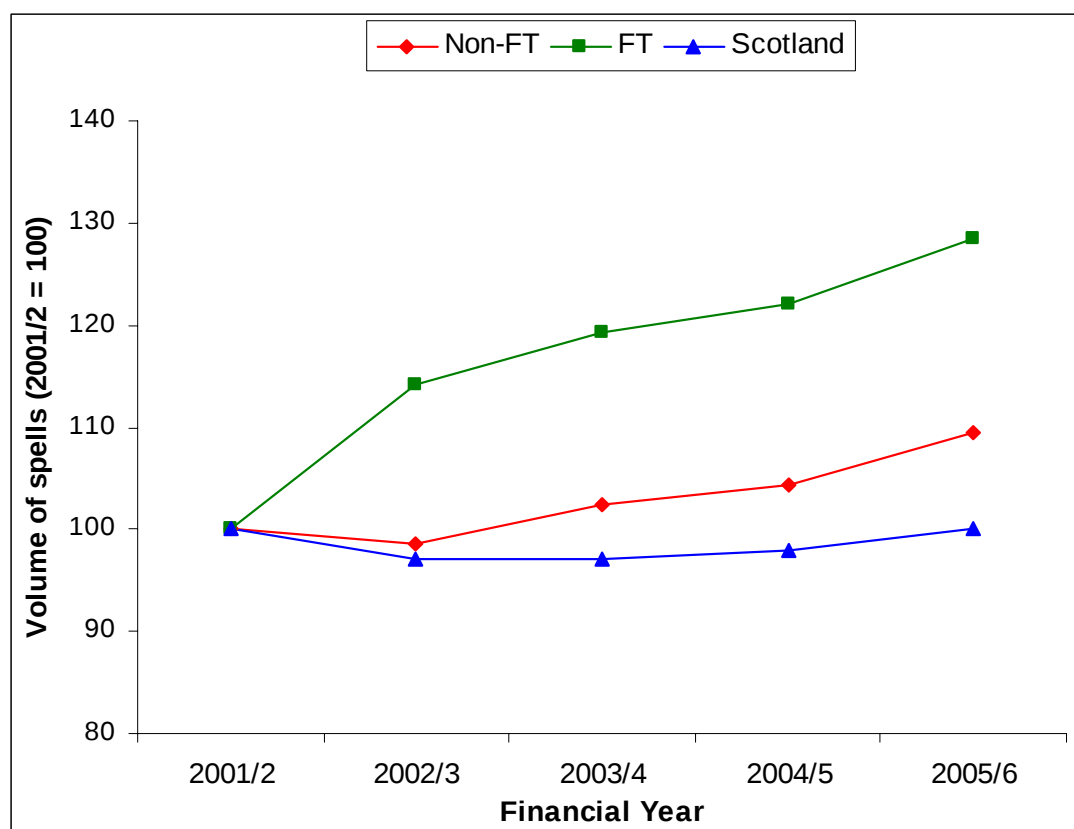
5.8.1 Volume of output: general trends

Total spells by country

Figure 5.4 shows the trends in the total number of spells of care provided by NHS hospitals in England and Scotland since 2001/2. Volumes are indexed on 2001/2 levels. Trusts that had become FTs by the end of the period experienced growth in spells in all years. Over the period, the volume of spells in non Foundation Trusts increased by 9%. In 2005/6, concurrent with the widespread application of PbR, growth in England was 5.0 per cent compared to 2.2 per cent in Scotland.

¹³ As part of these transition arrangements Trusts with costs above tariff must reduce these costs by 25% in 2005/6 to within 75% of tariff for Non-FTs in their first year of PbR and 25% in 2004/5 and 2005/6 to 50% of tariff in 2005/6 for FTs.

Figure 5.4 Trends in total number of spells by Non-FTs, FTs and Scotland



5.8.2 Volume of output: difference-in-difference analyses

As outlined in Section 4, there is no clear prediction from the economic framework that the volume of output will increase as a result of the introduction of the tariff. However, there is a general expectation as identified from the policy documentation in Section 2.1 that the tariff will encourage higher volumes of output. In this section we present the results of a series of DiD analyses designed to investigate whether there is evidence to support those expectations.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts. This included both elective and non-elective spells.

Table 5.13 shows a higher growth rate in spells for FTs than Scotland in 2004/5. This difference in growth is statistically significant at the 5 per cent level when we control for Trust and HRG effects. This presents weak evidence that there is an association between growth in volume and the introduction of the tariff. When we extend the period of analysis to examine the difference in growth from 2003/4 to 2005/6 (Table

5.14), we can see that looking at the longer term trends shows that the difference between FTs and Scotland is statistically significant offering some support for the hypothesis that the tariff has stimulated volume.

Table 5.13 FTs' DiD with Scotland in spells growth rate (%), 2003/4-2004/5

	Growth in spells, 2003/4-2004/5	Difference in Growth in spells
FTs	+2.01%	
Scotland	+0.57%	
Simple		+1.44 % points [*]
Adjusted		+1.33 % points [*]

Notes: * p<0.05. Excludes elective 15 HRGs.

Table 5.14 FTs' DiD with Scotland in growth rate (%) in all spells, 2003/4-2005/6

	Growth in spells, 2003/4-2005/6	Difference in Growth in spells
FTs	+7.36%	
Scotland	+2.29%	
Simple		+5.07 % points ^{**}
Adjusted		+4.95 % points ^{**}

Notes: ** p<0.01. Excludes elective 15 HRGs.

When we use non-FTs as the counterfactual, as shown in Table 5.15, the growth rate is higher in the non-FTs. However, there is no statistically significant difference between the two groups for both models.

Table 5.15 FTs' DiD with Non-FTs in spell growth rate (%), 2003/4-2004/5

	Growth in spells, 2003/4-2004/5	Difference in Growth in spells
FTs	+2.80%	
Non-FTs	+2.83%	
Simple		-0.03%pts [‡]
Adjusted		-0.25%pts [‡]

Notes: ‡ not significant. Excludes elective 15 and 33 HRGs.

b) In 2005/6 the application of the tariff was extended to all (with some exceptions) elective output provided by Non-FTs.

Table 5.16 shows that growth in both elective and non-elective spells for non-FTs in 2005/06 increased and that it was higher for elective spells. The difference between

the two types of spells is not statistically significant even after controlling for HRG mix.

Table 5.16 Elective growth in volume DiD with non-FTs for non-elective spells, 2004/5-2005/6

	Growth in spells, 2004/5-2005/6	Difference in Growth in spells
Elective	+6.26%	
Non-elective	+5.69%	
Simple		+0.57%pts‡
Adjusted		+0.76%pts‡

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes elective 15 and 33 HRGs.

From the comparison of Scotland and English Non-FTs in 2005/6, shown in Table 5.17, we can see the change in growth in elective care in 2005/6 was higher for the Non-FTs. This difference is statistically significant for both the adjusted and unadjusted models. The results support the expectation of higher growth in the newly tariffed elective spells. However, in Table 5.18 we can observe that activity on non-elective spells also grew more quickly in non-FTs than in Scotland. This is not what we would expect given that these non-elective spells are not subject to tariff.

Table 5.17 Non-FTs' DiD with Scotland in growth in volume of elective spells, 2004/5-2005/6

	Growth in spells, 2004/5-2005/6	Difference in Growth in spells
Non-FTs	+6.36%	
Scotland	+3.02%	
Simple		+3.34%pts**
Adjusted		+2.57%pts**

Notes: ‡ not significant, ** p<0.01, * p<0.05. Excludes elective 15 and 33 HRGs.

Table 5.18 Non-FTs' DiD with Scotland in volume of elective spells, 2004/5-2005/6

	Growth in spells, 2004/5-2005/6	Difference in Growth in spells
Non-FTs	+3.98%	
Scotland	+0.75%	
Simple		+3.22%pts**
Adjusted		+3.21%pts**

Notes: ** p<0.01. Excludes 15 and 33 HRGs.

Sub-group analysis

We interacted the difference in the growth rates with a binary variable indicating whether the non-FTs had a Reference Cost Index value above 100 in 2004/5. Forty-five percent of non-FTs had an RCI value above 100. The results adjusting for the initial HRG mix are shown in Table 5.19 for elective spells and non-elective spells in 2005/6. We find no difference in elective spells growth between high-cost or low-cost non-FTs. However, for non-elective spells the 'high-cost' non-FTs had growth rates that were 3.09% greater than that for the 'low-cost' non-FTs. This difference is highly significant (p<0.001).

Table 5.19 High-cost Non-FTs' DiD with low-cost Non-FTs for growth in spells, 2004/5-2005/6

Elective	Difference in growth of spells
Difference in difference (adjusted)	+1.04 % points‡
Non-elective	
Difference in difference (adjusted)	+3.09 %points**

Notes: ‡ not significant , ** p<0.01. Excludes elective 15 and 33 HRGs.

We also interacted growth rates with a binary variable indicating whether the non-FT was operating within a local health economy in surplus or deficit (where health economy is defined as the Strategic Health Authority). The results are shown in Table 5.20. Trusts operating within a local health economy which is in surplus had lower growth than those in a health economy in deficit. This difference is statistically significant and counter to expectations.

Table 5.20 Non-FTs in SHAs in surplus DiD with Non-FTs in SHAs in deficit for growth in spells, 2004/5-2005/6

Elective	Difference in growth of spells
Difference in difference (adjusted)	-3.27 percentage points**

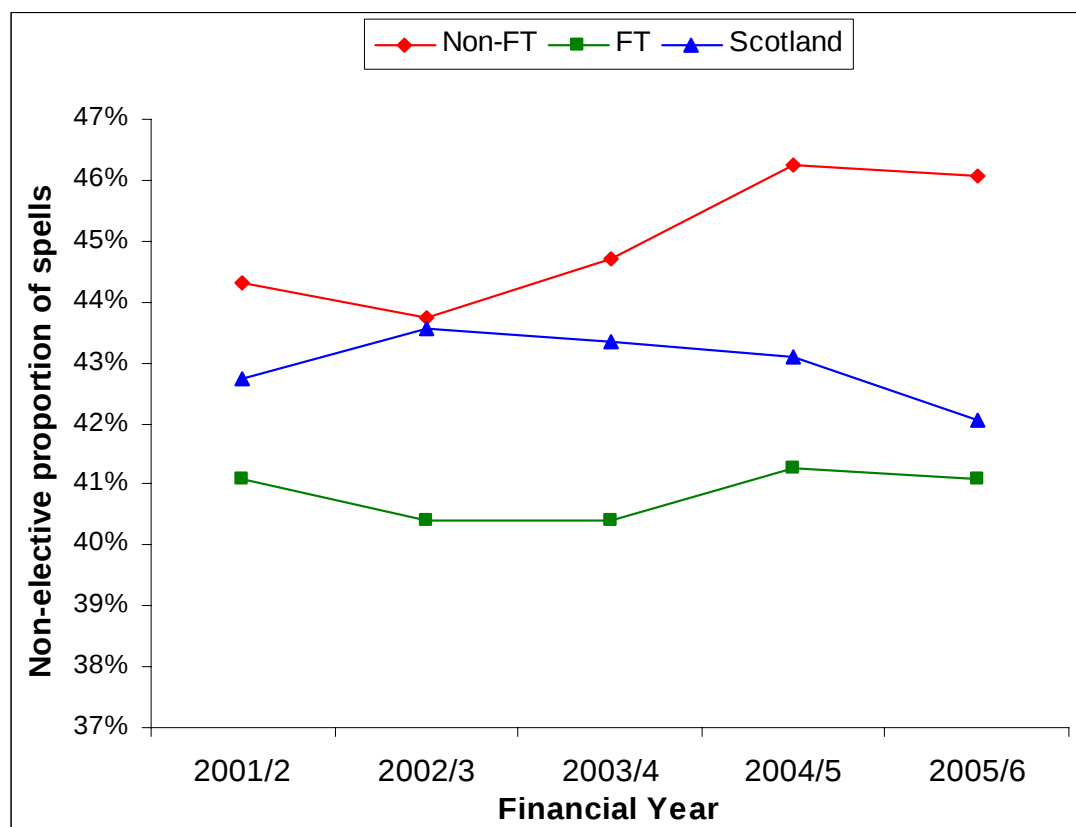
Notes: ** p<0.01. Excludes elective 15 and 33 HRGs.

5.8.3 Non-elective admissions: general trends

Non-elective admissions by country

Figure 5.5 presents trends in the proportion of spells admitted as non-electives in Non-FTs, FTs and Scotland. It shows the trend for the English NHS Trusts has diverged from that of Scotland. After an increase between 2001/2 and 2002/3, the proportion of non-elective admissions has fallen each year in Scotland. For the English NHS Trusts, after a fall in the proportion of non-elective admissions in 2002/3, there were two years of increases in the non-elective proportion. This increase was driven by a larger increase in the number of non-elective spells compared to elective spells, especially in 2003/4. There was a reduction in the proportion of non-elective admissions in 2005/6 when the increase in the number of non-elective spells was more similar to that for elective spells.

Figure 5.5 Trends in the proportion of non-elective admissions by Non-FTs, FTs and Scotland



Overall the non-elective proportion in England rose from 43.7 per cent in 2001/2 to 45.1 percent of admitted patient spells in 2005/6. It fell slightly in Scotland from 42.7 per cent to 42.0 per cent of output. This occurred during a period when non-elective admissions were causing concern in England following the introduction of two policy changes in the form of the maximum 4 hour A&E waiting target and the introduction of the relatively higher tariff for non-elective admissions for FTs (BMA, 2005).

5.8.4 Impact on non-elective admissions: difference-in-difference analyses

FTs received a higher tariff for patients with the same HRG code but categorised as non-elective admissions rather than elective admissions. As such, there may be an incentive to admit more non-elective patients (e.g. relax admission thresholds) than elective patients in order to increase revenue. We examine the evidence for such a change in behaviour in this section.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts. This included both elective and non-elective spells.

In 2004/5 Non-FTs experienced higher growth in the proportion of non-elective admissions than the FTs. Once we control for fixed effects the difference was very small and not statistically significant as shown in Table 5.21.

Table 5.21 FTs' DiD with Non-FTs in the proportion of non-elective admissions for all spells, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of non-elective	Difference in change in proportion of non-elective
FTs	54.30%	54.80%	+0.5 % points	
Non-FTs	57.60%	59.00%	+1.4 % points	
Simple				-1.0 % points **
Adjusted				-0.1 % points *

Notes: * p<0.05; ** p<0.01. Excludes the 15 and 33 HRGs.

In 2004/5 growth in the proportion of non-elective spells for FTs was small and positive. Using Scotland to represent the underlying trend, as shown in Table 5.22 growth was slightly higher in the FTs. This DiD was statistically significant suggesting an increase in non-elective admissions associated with the higher tariff.

Table 5.22 FTs' DiD with Scotland in the proportion of non-elective admissions for all spells, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of non-elective	Difference in change in proportion of non-elective
FTs	43.60%	44.00%	+0.4 %pts	
Scotland	45.80%	45.70%	-0.1 %pts	
Simple				+0.6 %pts **
Adjusted				+0.1 %pts *

Notes: * p<0.05; ** p<0.01. Excludes the 15 HRGs.

Over the two years to 2005/6, FTs increased the proportion of non-elective admissions and in Scotland they fell (Table 5.23). The difference is statistically significant in the unadjusted model. However, once we have controlled for changes in age-sex composition and Trust and HRG effects, although still in the same direction, the DiD is no longer statistically significant. This suggests that over the two year period there was no increase in the proportion of non-elective activity associated with the tariff.

Table 5.23 FTs' DiD with Scotland in the proportion of non-elective admissions for all spells, 2003/4-2005/6

	2003/4	2005/6	Change in proportion of non-elective	Difference in change in proportion of non-elective
FTs	37.84%	39.38%	+1.54 % points	
Scotland	48.08%	47.58%	−0.50 % points	
Simple				+2.5 % points **
Adjusted				+0.2 % points ‡

Notes: ‡ not significant at $p < 0.05$. Excludes the 15 HRGs.

5.8.5 Summary of effects on volume and pattern of care

We have examined whether the introduction of the tariff is associated with increases in the volume of care and changes in the pattern of the provision of care in 2004/5 and 2005/6. We undertook five main tests of the effects on the volume of care and three tests on the proportion of non-elective care. We analysed the results by subgroups of Trusts in surplus and deficit local health economies. A summary of these results is given in Table C2 of Appendix C.

Of the five main tests that we carried out on the volume of care, four provided support for the expectation that the tariff is associated with growth in activity. When we compare FTs and non-FTs with Scotland in 2004/5 and 2005/6, we see evidence of higher activity growth rates where the tariff is applied. However, (as for length of stay) when we use non-FTs as the control group for FTs in 2004/5, we observe no difference between the growth rates of the tariffed and un-tariffed groups respectively.

Both FTs and non-FTs were subject to challenging waiting time targets in 2004/5 (at March 2004, no one waiting more than 9 months after decision to admit and for December 2005, no-one waiting more than 6 months). Given that one of the criteria NHS Trusts had to meet to gain FT status in 2004 was low waiting times (see Chapter 2) it is feasible that FTs had already met the target and that non-FTs had to work much harder than FTs to meet these targets in 2004/5. Hence Non-FTs and FTs both had an incentive to increase volume but for the non-FTs it was more associated with waiting time targets than PbR.

By rewarding hospitals more for treating non-elective patients than elective patients coded as having the same spell HRG, an incentive to admit more non-elective patients is created. Given that Trusts are unlikely to be able to manage or manipulate the demand for non-elective admissions, changes in the proportion of non-elective patients are likely to reflect changes in the patient admission process. Therefore we have explored the data for evidence of increases in the volume of elective care for non-FTs and FTs and for increases in the proportion of non-elective care for FTs only in 2005/6. In the tests undertaken, we found no evidence of a disproportionate growth in non-elective care associated with the introduction of the tariff.

In the interviews we undertook, the limited global budget of the local economy was emphasised by respondents as a constraint on increasing capacity. Providers saw little point in doing extra on-tariff work that their PCTs could not afford without cutting the amounts paid for non-tariff work. Trusts were generally sensitive to the need to retain a stable local health economy and that required the local PCTs to be in financial balance. Some respondents considered the opportunity cost of increasing volume in one area of service would be a reduction in available funds in another area. Although the reductions could occur in another Trust's output, there was a general feeling that it could well appear in their own. There was also a sense of corporate responsibility evident in many places, a common purpose in serving the local population, and a consequent wish not to harm other providers and their patients.

For the subgroup analysis, we found that Trusts operating in a local health economy which was in deficit the previous year were more likely to have higher growth rates in the following year. We had anticipated that local health economies with a surplus might be more likely to expand output as the local health economy would be less constrained. However, this is not upheld by the results.

The higher growth has been observed despite the suggestions by the interviewees that there was limited opportunity to increase volume for two main reasons. The first relates to capacity constraints and the second relates to limited local budgets or lack of excess demand. We asked interviewees in all three rounds of qualitative analysis

about their perceptions of whether and how PbR was affecting the volume of activity undertaken in their local health economies. Most respondents identified increases in activity but were inclined to attribute this to continuations of past trends and to the pressure to reduce waiting times for elective care. A few respondents took the view that, because their hospital's capacity was already fully used or the ability of local PCTs to pay for more work did not exist, they were trying to discourage rather than encourage increased activity.

One of the objectives of the PbR system was to introduce 'greater transparency and planning certainty in the system' (DH, 2002a). From the interviews, managers and clinicians lacked confidence in the robustness of the costs on which the prices were based, and had limited confidence in the stability of the tariff over time. This meant that, although business plans to increase capacity were simpler to construct in a system of guaranteed fixed prices than they had been pre-PbR, such plans were thought to be vulnerable to unpredictable changes in those prices. Such uncertainty would not be conducive to long term capacity increasing capital schemes.

The increases in volume observed in this study are short-term. Further investigations should examine whether PbR has had an affect on the ability to increase capacity and hence may also stimulated longer-term future increases in volume.

Within the period of our study, only the FTs were faced with a tariff-based incentive to increase the proportion of non-elective admissions. The DiD was positive and significant for the FTs when Scotland was used as the control in 2004/5 but not when English non-FTs were used as the control. The 4-hour wait targets set for Accident and Emergency departments during this period may have had an affect in the same direction, thereby confounding the results. These targets applied to non-FTs as well as FTs in England but not to Trusts in Scotland during 2004/5 and 2005/6¹⁴. Given that a DiD is only evident when measured against Scotland in 2004/5, this may strengthen

¹⁴ Policy guidance in *Fair to All, Personal to Each: the next steps for NHSScotland* introduced a commitment that "from the end of 2007, patients will wait no longer than 4 hours between arriving at a Unit and admission, discharge or transfer". However, data for monitoring this were not collected systematically until 2006.

the argument that increases in non-elective admissions were driven at least partly by the A&E 4-hour wait target¹⁵.

There is consistent evidence of both non-FTs and FTs responding to the tariff by increasing volumes of inpatient care and that some of the observed differences with Scotland may be attributable to differences in the waiting time target regimes. There is inconsistent evidence that FTs increased the proportion of non-elective admissions, but again this may be attributable to other policy initiatives in England such as the 4-hour A&E wait.

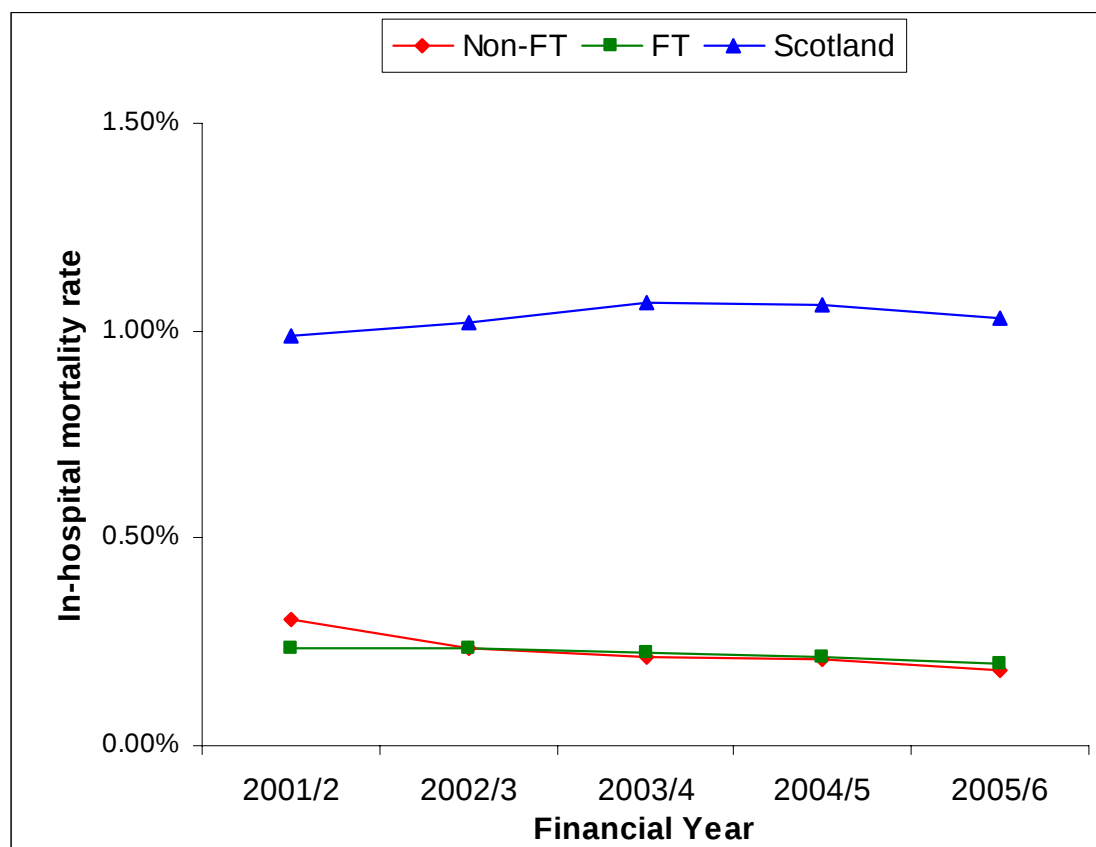
5.9 Effects on the Quality of Care

5.9.1 Hospital mortality: general trends

Hospital mortality for elective spells is lower in the English NHS Trusts than in Scotland. From 2002/3 to 2005/6, FTs and Non-FTs have had reductions in hospital mortality whereas in Scotland there was an increase from 2001/2 to 2003/4 followed by reductions thereafter. Shown in Figure 5.6.

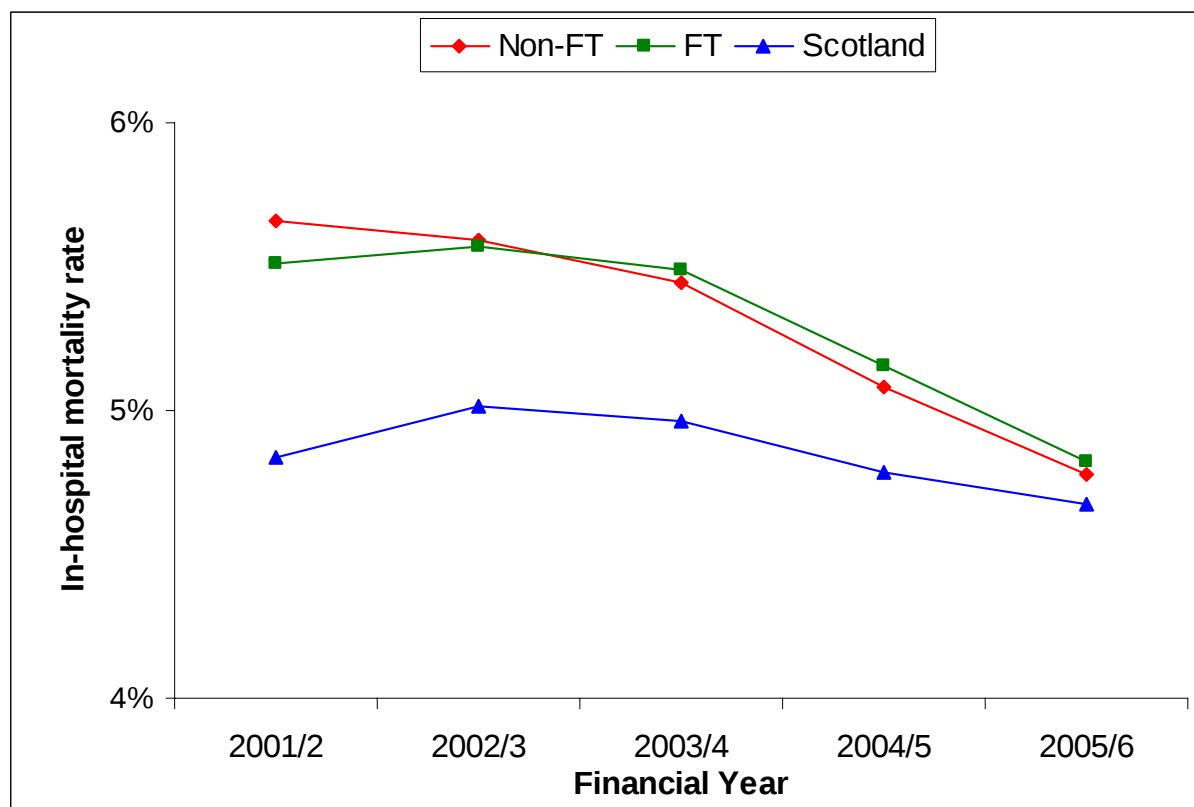
¹⁵As described in Chapter 2 the NHS Plan 2000 set out an accident and emergency target of four hours from arrival to admission, transfer or discharge to be achieved by 2004.

Figure 5.6 Trends in hospital mortality for elective spells in Non-FTs, FTs and Scotland



As shown in figure 5.7, all types of organisation have experienced reductions in non-elective hospital mortality since 2002/3. Generally, the reductions have been steeper for the English NHS Trusts than Scotland.

Figure 5.7 Trends in hospital mortality for non-elective spells in Non-FTs, FTs and Scotland



5.9.2 Hospital mortality: difference-in-difference analyses

We identify in Chapter 3 that PbR is expected to have a positive effect on the quality of care¹⁶. As outlined there, other things equal the introduction of PbR will increase incentives to control unit costs but may result in some economising on quality of care¹⁷. In this section we use DiD analyses to examine if there have been changes in the quality of care and what direction those changes have taken.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by FTs. This included both elective and non-elective spells.

As shown in Table 5.24, in-hospital mortality fell by the same percentage points for the FTs and for Scotland in 2004/5. Once we control for changes in the age-sex

¹⁶ These effects are likely to be strongest when PbR is combined with Patient Choice policy. However, Patient Choice policy was not widely introduced in England until the last quarter of our data.

¹⁷ We also acknowledge in Section 4 that there may be factors which mitigate the quality reducing effects of the tariff.

composition of admitted patients and differences between Trusts and HRGs a difference emerges but this is not statistically significant. These results indicate that the tariff had neither a beneficial or detrimental effect on the quality of care for FTs in 2004/5.

Table 5.24 FTs' DiD with Scotland in hospital mortality, 2003/4-2004/5

	2003/4	2004/5	Change in hospital mortality rates	Difference in change in hospital mortality rates
FTs	2.51%	2.42%	−0.09 % points	
Scotland	2.94%	2.85%	−0.09 % points	
Simple				0.00 % points ‡
Adjusted				−0.05 % points ‡

Notes: ‡ not significant at $p < 0.05$, * $p < 0.05$; ** $p < 0.01$. Excludes the 15 HRGs.

Looking at a two year period in Table 5.25, in-hospital mortality fell by more percentage points in Scotland than for the FTs from 2003/4 to 2005/6. However, when we control for changes in age-sex composition and Trust and HRG effects, FTs are shown to have greater reductions in in-hospital mortality over the period. This is a statistically significant result showing that quality of care has improved in association with the introduction of the tariff.

Table 5.25 FTs' DiD with Scotland in hospital mortality, 2003/04-2005/6

	2003/4	2005/6	Change in hospital mortality rates	Difference in change in hospital mortality rates
FTs	2.62%	2.27%	−0.35 % points	
Scotland	3.06%	2.88%	−0.18 % points	
Simple				0.16 % points **
Adjusted				−0.28 % points **

Notes: ** significant at $p < 0.01$. Excludes elective 15 HRGs.

If we use Non-FTs as the counterfactual, there is no statistically significant difference between the two groups. Shown in Table 5.26.

Table 5.26 FTs' DiD with Non-FTs in hospital mortality, 2003/4-2004/5

	2003/4	2004/5	Change in hospital mortality rates	Difference in change in hospital mortality rates
FTs	2.28%	2.19%	-0.09 % points	
Non-FTs	2.45%	2.35%	-0.10 % points	
Simple				0.00 % points [‡]
Adjusted				+0.01 % points [‡]

Notes: ‡ not significant at p<0.05, * p<0.05, ** p<0.01; Excludes the 15 and 33 HRGs.

b) In 2005/6 the application of the tariff was extended to all (with some exceptions) elective output provided by Non-FTs

In 2005/6 Non-FTs had a greater absolute reduction in elective in-hospital mortality compared with Scotland. However, the difference is not statistically significant as shown in Table 5.27. The same comparison for non-elective activity shows a reduction in non-elective in-hospital mortality associated with the introduction of the tariff in 2005/6 for non-FTs (Table 5.28).

Table 5.27 Non-FTs' DiD with Scotland in hospital mortality elective care, 2004/5-2005/6

	2004/5	2005/6	Change in hospital mortality rates	Difference in change in hospital mortality rates
Non-FTs	0.23%	0.20%	-0.03 % points	
Scotland	1.46%	1.43%	-0.02 % points	
Simple				-0.010 % points [‡]
Adjusted				-0.004 % points [‡]

Notes: ‡ not significant at p<0.05, * p<0.05; ** p<0.01. Excludes the 15 and 33 HRGs.

Table 5.28 Non-FTs' DiD with Scotland in hospital mortality non-elective care, 2004/5-2005/6

	2004/5	2005/6	Change in hospital mortality rates	Difference in change in hospital mortality rates
Non-FTs	5.34%	4.98%	-0.36 % points	
Scotland	4.81%	4.75%	-0.06 % points	
Simple				-0.29 % points **
Adjusted				-0.23 % points **

Notes: ‡ not significant at p<0.05, * p<0.05; ** p<0.01. Excludes the 15 and 33 HRGs.

As shown in Table 5.29, the reduction in hospital mortality for Non-FTs is higher in the non-tariffed non-elective output than in the tariffed elective output in 2005/6. This statistically significant DiD, offers the only evidence that the tariff might slow improvements in the quality of care.

Table 5.29 Elective output DiD with non-elective output in hospital mortality Non-FTs, 2004/5-2005/6

	2004/5	2005/6	Change in hospital mortality rates	Difference in change in hospital mortality rates
Elective	0.23%	0.20%	-0.03 % points	
Non-elective	5.34%	4.98%	-0.36 % points	
Simple				+0.33 % points **
Adjusted				+0.27 % points **

Notes: ** p<0.01. Excludes the 15 and 33 HRGs.

Subgroup analysis

We also tested whether the changes in the in-hospital mortality rates differed between high-cost and low-cost non FTs. The high cost non-FTs experienced greater reductions in hospital mortality than the low cost non-FTs. This result, presented in Table 5.30 is statistically significant but is counter to expectations as we would expect the providers with costs below the tariff to be better placed to use resources to increase the quality of care and for high cost providers to be focussing on reducing costs rather than increasing quality.

Table 5.30 High cost Non-FTs' DiD with low cost Non-FTs for hospital mortality, 2004/5-2005/6

Difference in change in hospital mortality rates	
Simple	-0.06 % points **
Adjusted	-0.06 % points **

Notes: ** p<0.01. Excludes elective 15 and 33 HRGs.

5.9.3 30-day mortality: general trends

Figure 5.8 presents the trends in 30-day post elective surgical mortality for Non-FTs, FTs and Scotland for 2001/2 to 2005/6. The rate for Scotland is consistently higher over the period. The Non-FTs and FTs have similar rates with the FTs being slightly higher throughout. The rates in English NHS Trusts have been steady or falling during the period 2001/2 to 2005/6. This contrasts with Scotland which saw increases in mortality until 2004/5, followed by a fall in 2005/6.

Figure 5.8 Trends in 30-day elective surgical mortality for Non-FTs, FTs and Scotland

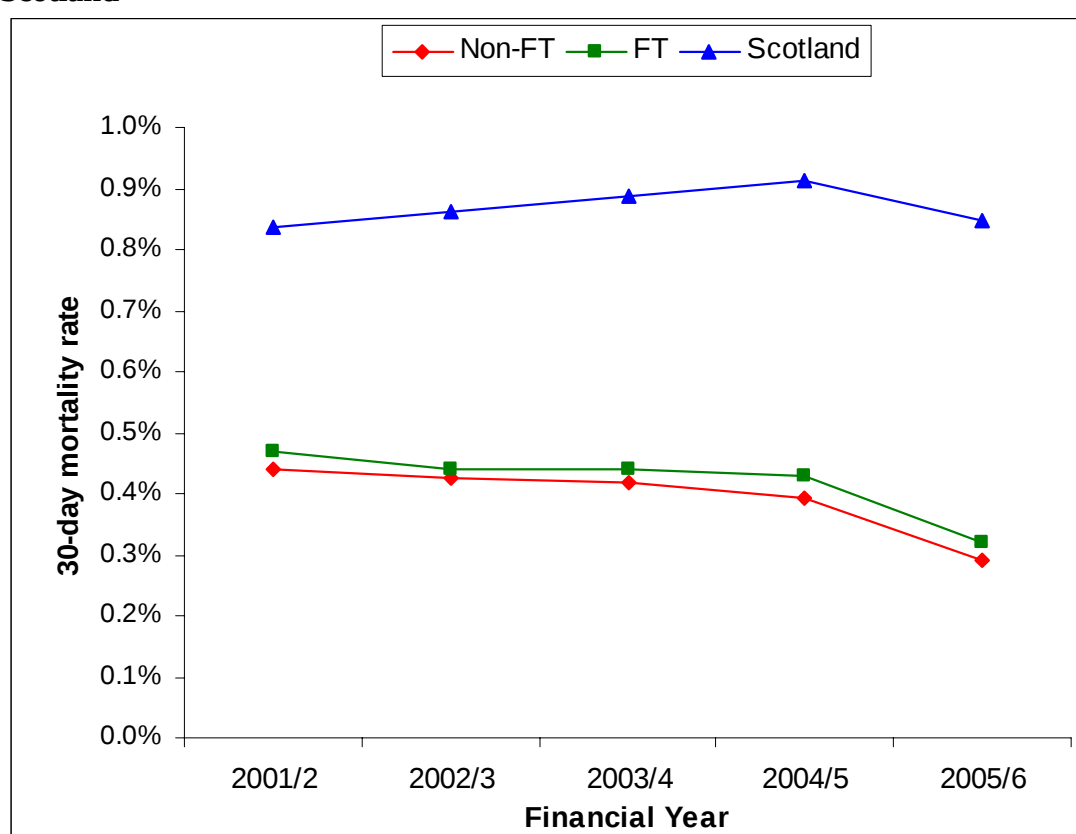
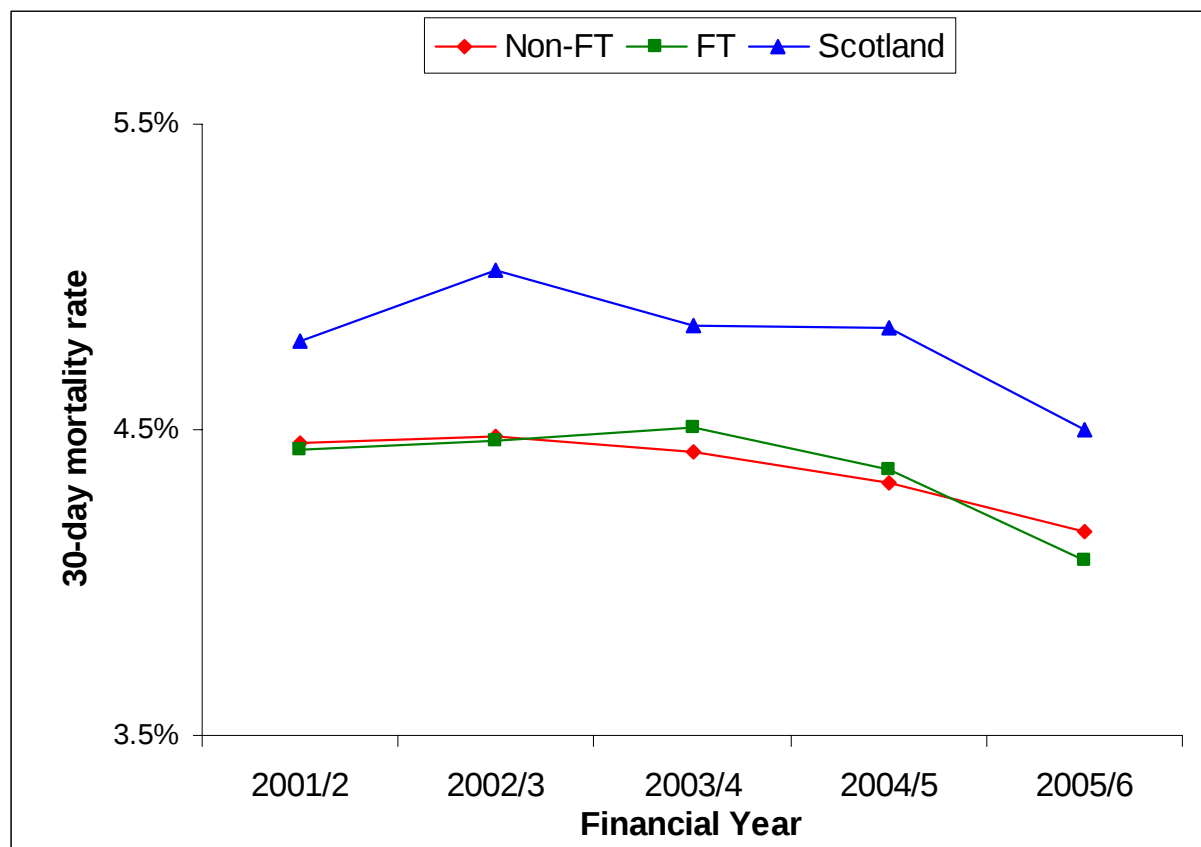


Figure 5.9 shows Scotland's 30-day surgical mortality rate for non-elective spells to be consistently higher than FTs and non-FTs for period 2001/2 to 2005/6. All three

groups had a lower rate in 2005/6 compared to 2001/2 with FTs ending the period with the lowest 30-day mortality.

Figure 5.9 Trends in 30-day non-elective surgical mortality for Non-FTs, FTs and Scotland



5.9.4 30-day surgical mortality: difference-in-difference analyses

In this section we use DiD analyses to test this hypothesis that the tariff may have had a detrimental affect on the quality of care using 30-day surgical mortality as a measure of quality of care.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts in 2004/5. This included both elective and non-elective spells.

There is no statistically significant difference in the change in post-surgical 30-day mortality between FTs and non-FTs in 2004/5 (Table 5.31).

Table 5.31 FTs' DiD with Non-FTs in 30-day post surgical mortality, 2003/4-2004/5

	2003/4	2004/5	Change in 30-day post surgical mortality rate	Difference in change in 30-day post surgical mortality rate
FTs	1.26%	1.27%	+0.01 % points	
Non-FTs	1.31%	1.29%	-0.02 % points	
Simple				+0.04 % points ‡
Adjusted				+0.01 % points ‡

Notes: ‡ not significant at $p < 0.05$, * $p < 0.05$; ** $p < 0.01$. Excludes the 15 and 33 HRGs.

Table 5.32 shows that FTs' 30-day post surgical mortality fell more quickly than that of Scotland in the two year period, 2003/4 to 2005/6. However, the difference is not statistically significant even when we control for changes in age-sex composition and Trust and HRG effects.

Table 5.32 FTs' DiD with Scotland in 30-day post surgical mortality, 2003/4 to 2005/6

	2003/4	2005/6	Change in 30-day post surgical mortality rate	Difference in change in 30-day post surgical mortality rate
FTs	1.18%	1.01%	-0.17 % points	
Scotland	2.07%	1.98%	-0.09 % points	
Simple				-0.08 % points ‡
Adjusted				-0.00 % points ‡

Notes: ‡ not significant at $p < 0.05$. Note: Excludes elective 15 HRGs

The comparison with Scotland shown in Table 5.33 again shows no statistically significant results suggesting that there is no association between the introduction of the tariff and 30-day post surgical mortality for FTs in 2004/5.

Table 5.33 FTs' DiD with Scotland in 30-day post surgical mortality, 2003/4-2004/5

	2003/4	2004/5	Change in 30-day post surgical mortality rate	Difference in change in 30-day post surgical mortality rate
FTs	1.22%	1.23%	+0.01 % points	
Scotland	2.12%	2.18%	+0.06 % points	
Simple				−0.05 % points ‡
Adjusted				+0.03 % points ‡

Notes: ‡ not significant at $p < 0.05$, * $p < 0.05$; ** $p < 0.01$. Excludes the 15 HRGs.

b) In 2005/6 when the application of the tariff was extended to all (with some exceptions) elective output provided by Non-FTs

The DiD in Table 5.34 is generated using Scotland as the counterfactual for Non-FTs in 2005/6. It shows that the reduction in mortality was greater in Non-FTs than in Scotland but that this was not statistically significant.

Table 5.34 Non-FTs DiD with Scotland in 30-day post elective surgical mortality, 2004/5-2005/6

	2004/05	2005/06	Change in 30-day post surgical mortality rate	Difference in change in 30-day post surgical mortality rate
Non-FTs	0.45%	0.35%	−0.10 %pts	
Scotland	1.18%	1.11%	−0.07 %pts	
Simple				−0.02 %pts ‡
Adjusted				−0.05 %pts ‡

Notes: ‡ not significant at $p < 0.05$, * $p < 0.05$; ** $p < 0.01$; Excludes the 15 and 33 HRGs

Subgroup analysis

We also tested whether the changes in the 30-day mortality rate differed between high-cost and low-cost non FTs. Surgical mortality fell more quickly in high cost non-FTs than low cost non-FTs in 2005/6. The difference, shown in Table 5.35, was significantly different but counter to the expected direction because we would expect low cost providers to have greater opportunities to increase the quality of care.

Table 5.35 High cost Non-FTs' DiD with low cost Non-FTs for 30-day post surgical mortality, 2004/5-2005/6

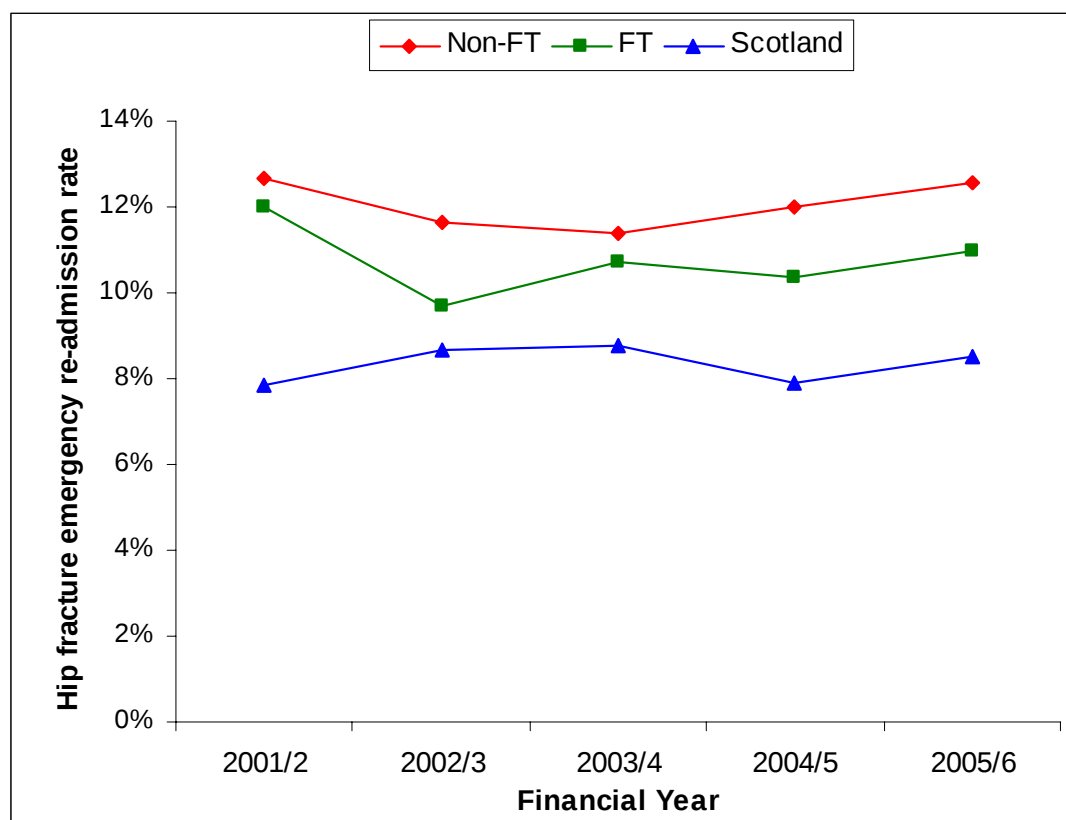
Difference in change in 30-day post surgical mortality rate	
Simple	−0.08 %pts **
Adjusted	−0.05 %pts **

Notes: ** p<0.01. Excludes elective 15 and 33 HRGs.

5.9.5 Emergency re-admission following hip fracture: general trends

Figure 5.10 presents the trends in emergency readmissions following hip fracture for Non-FTs, FTs and Scotland for 2001/2 to 2005/6. The rate for Scotland is consistently lower over the period. The Non-FTs have the highest rates. The rate in Non-FTs declines in the first two years and increases from 2003/4 onwards. The rates in FTs and Scotland are more variable as they are based on smaller numbers.

Figure 5.10 Trends in hip fracture emergency readmission rates for Non-FTs, FTs and Scotland



5.9.6 Emergency readmission following treatment for hip fracture: difference-in-difference analyses

In this section we use DiD analyses to test this hypothesis that the tariff may have had a detrimental affect on the quality of care using emergency readmission following treatment for hip fracture as a measure of quality of care.

a) In 2004/5 and 2005/6 the tariff was applied to all spells (with some exceptions) provided by Foundation Trusts. This included both elective and non-elective spells.

Emergency readmissions following treatment for hip fracture fell for FTs and grew for non-FTs in 2004/5. However, the difference is not statistically significant. The DiDs in Table 5.36 offers no support for the hypothesis that incentives to reduce unit costs might adversely affect the quality of care.

Table 5.36 FTs' DiD with Non-FTs in emergency readmissions following treatment for hip fracture, 2003/4-2004/5

	2003/4	2004/5	Change in rate of emergency readmissions	Difference in change in rate of emergency readmissions
FTs	10.57%	10.49%	-0.08 % points	
Non-FTs	11.41%	11.96%	+0.55 % points	
Simple				-0.63 % points [‡]
Adjusted				-0.68 % points [‡]

Notes: ‡ not significant at $p < 0.05$, * $p < 0.05$; ** $p < 0.01$. Excludes the 15 and 33 HRGs.

The comparison with Scotland shown in Table 5.37 shows that both FTs and Scotland reduced emergency readmission following treatment for hip fracture and that the reduction was greater in Scotland. However, the difference between the two groups is not statistically significant and thus offers no support for the hypothesis that there is a change in mortality associated with the introduction of the tariff.

Table 5.37 FTs' DiD with Scotland in emergency readmissions following treatment for hip fracture, 2004/5

	2003/4	2004/5	Change in rate of emergency readmissions	Difference in change in rate of emergency readmissions
FTs	10.57%	10.49%	−0.08 % points	
Scotland	8.77%	7.92%	−0.85 % points	
Simple				+0.77 % points ‡
Adjusted				+0.73 % points ‡

Notes: ‡ not significant at $p < 0.05$, * $p < 0.05$; ** $p < 0.01$.

As above there is not statistically significant difference between the non-FTs and Scotland even when we extend the analysis to two years of data (Table 5.38).

Table 5.38 FTs' DiD with Scotland in emergency readmissions following treatment for hip fracture, 2003/4-2005/6

	2003/04	2005/06	Change in rate of emergency readmissions	Difference in change in rate of emergency readmissions
FTs	12.0%	10.9%	−1.1 % points	
Scotland	8.8%	8.5%	−0.3 % points	
Simple				−0.9 % points ‡
Adjusted				−1.2 % points ‡

Notes: ‡ not significant at $p < 0.05$.

b) In 2005/6 when the application of the tariff was extended to all (with some exceptions) elective output provided by Non-FTs

The DiD in Table 5.39 is generated using Scotland as the counterfactual for Non-FTs in 2005/6. It shows that both groups had similar increases in the emergency readmission rate following treatment for hip fracture.

Table 5.39 Non-FTs' DiD with Scotland in emergency readmissions following treatment for hip fracture, 2004/5-2005/6

	2004/05	2005/06	Change in rate of emergency readmissions	Difference in change in rate of emergency readmissions
Non-FTs	12.0%	12.5%	+0.5 % points	
Scotland	7.9%	8.5%	+0.6 % points	
Simple				+0.0 % points [‡]
Adjusted				+0.0 % points [‡]

Notes: ‡ not significant at p<0.05, * p<0.05; ** p<0.01

Subgroup analysis

Subgroup analysis in Table 5.40 shows no difference in the change in emergency readmissions following treatment for hip fracture between low- and high-cost non-FTs.

Table 5.40 High-cost Non-FTs' DiD with low-cost Non-FTs in emergency readmission following treatment for hip fracture, 2004/5-2005/6

	Difference in change in rate of emergency readmissions
Simple	-0.1 %pts [‡]
Adjusted	-0.1 %pts [‡]

Notes: ‡ not significant at p<0.05, * p<0.05; ** p<0.01

5.9.7 Hospital level measures of quality of care

We undertook preliminary analysis of the effects of the tariff on the rate of MRSA as a proportion of bed days, the proportion of cancelled operations, the number of emergency readmissions, hospital 30-day mortality following surgery and proportion of inpatients waiting less than 6 months in 2003/04 and 2004/05. The results of this were presented in the Interim Report produced for the Advisory Group in October 2006. We found no statistically significant effects. This is likely to reflect a lack of statistical power of analysis at provider level. For completeness these results are shown in Table C8 in Appendix C.

5.9.8 Summary of effects on quality

We have examined whether the introduction of the tariff is associated with changes in the quality of care in 2004/5 and 2005/6 measured by in-hospital mortality, 30-day

post-surgical mortality and emergency readmissions following treatment for hip fracture. We undertook five main tests of the effects on in-hospital mortality and four main tests on the other two variables. We also analysed the results by subgroups of low cost and high costs Trusts. A summary of these results is given in Table C3 of Appendix C.

Overall, the quantitative evidence does not support the policy expectation that the introduction of PbR would lead to increases in the quality of care. The results show no association between 30-day mortality and emergency readmissions following hip fracture and the introduction of tariff for FTs or non-FTs in 2004/5 and 2005/6. For in-hospital mortality, we see greater reductions for non-FTs in 2005/6. For FTs this difference is evident when we look at two years of data, 2003/4 to 2005/6.

Equally, there is no evidence to suggest that the quality of care (as measured in this study) is being adversely affected by the introduction of the PbR in 2004/5 and 2005/6.

The subgroup analysis showed that high cost non-FTs had significantly larger reductions in in-hospital mortality and 30-day post surgical mortality than low cost non-FTs in 2005/6. It might have been expected that high cost providers would have to work harder to reduce their costs below tariff and would be more likely to experience reductions in the quality of care in the process. However, what appears to be happening is that high cost providers are better maintaining the quality of care. One explanation is that high costs are a *consequence* of higher quality and that higher cost providers are maintaining their commitment to quality in spite of a less cost sensitive payment system. Whether this is sustainable in the longer run is questionable.

When we first interviewed NHS managers, in summer 2005, their expectations with respect to the impact of PbR on the quality of patient care were quite varied. Some feared PbR might damage patient quality, or at least deter improvements, in some places because of the need to keep costs below the nationally fixed tariff level. One interviewee feared that because the PbR tariff is based on national average costs it would produce “average quality services”. Others expected no impact on quality. But

none considered that PbR was at that early stage stimulating Trusts to compete on quality. This view continued to predominate during our 2006 round of interviews.

In almost all Trusts where we interviewed, care quality was driven by clinical and not financial considerations. Specialised Trusts, in particular, were confident that they would retain their market position because of a reputation for quality provision but did not have plans to enhance that quality in order to win patients away from other providers.

In conclusion, the views expressed in the interviews with respect to PbR having limited effect on the quality of care appear to be upheld by the quantitative analysis. PbR appears so far neither to be enhancing nor damaging quality of care.

5.10 Outpatients

We undertook a series of analyses on changes in the patterns of outpatient services. As with the admissions analysis above, we used measures of efficiency and volume. For efficiency we used: the return ratio which measures the ratio between first attendances and all subsequent attendances in outpatients and; the 'did not attend' (DNA) rate as a measure of hospitals' ability to manage resources and patients effectively.

To measure the changes in volume of outpatient care we used first admissions and all admissions.

We also used volume of GP referred outpatients as an indicator of the effectiveness of demand management or a shift towards the provision of outpatient services in the community.

We used volume of other referrals as an indicator of Trust generated referral, both as an absolute and proportion of total referral. This is the only indicator which showed a statistically significant difference in growth. There was an increase in Trust generated referrals associated with introduction of the outpatients tariff.

The extent to which we were able to use Scotland as a control varied with different measures. The completeness and comparability of data over the period of analysis (2002/3 to 2006/7) and between England and Scotland was different for different variables. Our analysis was restricted by this lack of comparability and changes in the definitions of variables. Table 5.41 below summarises the results of the outpatient analysis. Table D2 in Appendix D shows the excluded specialties of outpatient service.

The results clearly show that there has been only one statistically significant change in the pattern of outpatient provision which can be associated with the introduction of the outpatient tariff under the PbR system.

5.11 Specific HRG investigations

In this section we investigate trends in specific HRGs for evidence of whether there have been changes in the coding of patients and changes in the way patients are treated as a result of differences in tariffs for pairs and groups of HRGs which are similar in diagnosis and procedure. The HRGs analysed in this section and the behaviours investigated have been informed through discussions with the project advisory group.

5.11.1 Primary hip replacement

Primary hip replacement can be undertaken as uncemented (HRG code: H80) or cemented (HRG code: H81). There is a general view¹⁸ that the elective tariff for uncemented should be higher than the cemented tariff. However, the tariff has been set so that cemented is reimbursed at a higher rate. As a result the DH are considering for 2008/09 to adjust the elective tariff for H81 so that it is higher than H80.

We investigate here whether the higher tariff for the cemented has had the effect of shifting activity toward cemented and away from uncemented. We use elective cemented activity as a proportion of cemented and uncemented activity. As our dependent variable and examine changes in the growth of this proportion over time.

¹⁸ Information provided by the project advisory group.

Table 5.42 shows that the proportion of elective cemented hip replacement fell for FTs in 2004/05. This compares with an increase in Scotland. This difference is statistically significant and is counter to expectations.

Table 5.43 shows that the proportion of elective cemented hip replacement for non-FTs fell in 2005/06. As for FTs in the previous table, this compares with an increase in Scotland and the difference is statistically significant.

Table 5.41 Effects of tariff on key variables: size of effect and statistical significance

Treatment	Control	Adjusted for specialty mix	Year	DNA	Return ratio	All attendances	First attendances	GP referrals	Other referrals	Other referrals (%)
FTs	Non-FTs	No	04/05					-0.016 [‡]	0.023 [‡]	0.0073 [‡]
FTs	Non-FTs	Yes	04/05					-0.015 [‡]	0.023 [‡]	0.0057 [‡]
FTs	Non-FTs	No	05/06					-0.013 [‡]	0.041 ^{**}	0.0082 [‡]
FTs	Non-FTs	Yes	05/06					-0.016 [‡]	0.041 ^{**}	0.0087 [‡]
Non-FTs	Scotland	No	06/07	0.11 [‡]	0.0026 [‡]	-0.016 [‡]	-0.0039 [‡]			
Non-FTs	Scotland	Yes	06/07	0.11 [‡]	0.0024 [‡]	-0.0055 [‡]	0.0045 [‡]			
FTs	Scotland	No	06/07	0.26 [‡]	0.11 [‡]	0.011 [‡]	-0.0027 [‡]			
FTs	Scotland	Yes	06/07	0.25 [‡]	0.080 [‡]	0.016 [‡]	0.0028 [‡]			
FTs	Non-FTs	No	06/07	0.15 [‡]	0.082 [‡]	0.027 [*]	0.0012 [‡]	0.0062 [‡]	0.038 [‡]	0.0076 [‡]
FTs	Non-FTs	Yes	06/07	0.13 [‡]	0.077 [‡]	0.026 [*]	0.0021 [‡]	0.0103 [‡]	0.036 [‡]	0.0084 [‡]

Notes: ‡ not significant at p<0.05, * p<0.05; ** p<0.01

These results suggest that counter to expectations there has been no increase in the proportion of elective cemented hip replacement as a result of the introduction of the tariff.

Table 5.42 FTs' DiD with Scotland in proportion of cemented spells in all elective spells, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of cemented spells	Difference in change in proportion of cemented spells
FTs	83.0%	80.9%	-2.1 % points	
Scotland	96.9%	97.4%	+0.5 % points	
Simple				-2.6 % points ^{**}
Adjusted				-1.4 % points [*]

Notes: * p<0.05 ** p<0.01

Table 5.43 Non-FTs' DiD with Scotland in proportion of cemented spells in all elective spells (cemented and uncemented), 2004/5-2005/6

	2004/5	2005/6	Change in proportion of cemented spells	Difference in change in proportion of cemented spells
Non-FTs	79.4%	74.1%	-5.3 % points	
Scotland	97.4%	97.0%	-0.4 % points	
Simple				-4.9 % points ^{**}
Adjusted				-4.6 % points ^{**}

Notes: ** p<0.01

5.11.2 Maternity care

We undertake a series of investigations under the coding and tariff for maternity care.

N12. Antenatal Admissions not related to delivery event

The Department of Health have received feedback through consultation that Trusts have an incentive to admit to HRG N12 for activity that could be carried out in an outpatient clinic. Evidence to support this would be found in increases in the volume of N12 and decreases in the average length of stay.

Tables 5.44 to 5.47 show the DiD analysis for FTs and non-FTs in 2004/5 and 2005/6 using the usual control groups. The dependent variable is the growth rate in elective and non-elective spells coded as N12. We find no statistically significant growth in activity in N12 which is counter to the expected pattern of provision.

Table 5.44 FTs' DiD with Non-FTs in spell growth rate (%) in N12, 2003/4-2004/5

	Change in proportion of 'with complications', 2003/4-2004/5	Difference in change in proportion of 'with complications'
FTs	12.86 % points	
Non-FTs	5.43 % points	
Simple		7.43 % points [‡]

Notes: ‡ not significant at p<0.05

Table 5.45 FTs' DiD with Scotland in spells growth rate (%) in N12, 2003/4-2004/5

	Change in proportion of 'with complications', 2003/4-2004/5	Difference in change in proportion of 'with complications'
FTs	12.86 % points	
Scotland	1.89 % points	
Simple		10.96 % points [‡]

Notes: ‡ not significant at p<0.05

Table 5.46 Non-FTs' DiD with Scotland in growth rate (%) in N12, 2004/5-2005/6

	Change in proportion of 'with complications', 2004/5-2005/6	Difference in change in proportion of 'with complications'
Non-FTs	8.18 % points	
Scotland	1.47 % points	
Simple		6.72 % points [*]

Notes: * p<0.05

Table 5.47 FTs' DiD with Scotland in spells growth rate (%) in N12, 2004/5-2005/6

	Change in proportion of 'with complications', 2004/5-2005/6	Difference in change in proportion of 'with complications'
FTs	6.25%pts	
Scotland	1.47%pts	
Simple		4.78% points [‡]

Notes: ‡ not significant at p<0.05

N06 normal delivery versus N07 normal delivery with complications.

There is scope for a case with no complications to be coded as with complications due to the lack of definite guidelines as to what constitutes a 'complication' in maternity care. Given that the tariff is higher for N07 with complications this provides Trusts

with an opportunity to gain more revenue at no extra cost by coding upwards from N06 to N07.

There is some evidence of such ‘up-coding’ in our analysis. Compared to Scotland non-FTs have a statistically significant higher growth in the proportion of normal deliveries ‘with complications’ in 2005/6 (see Table 5.50). However, for 2004/5 when we compare FTs to Scotland, there is no statistically significant difference (Table 5.49). Using non-FTs as the control for FTs in 2004/5, the difference is statistically significant but in the opposite direction to what we would expect (Table 5.48).

Table 5.48 FTs’ DiD with non-FTs in proportion of ‘with complications’ spells in all normal delivery spells, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of ‘with complications’	Difference in change in proportion of ‘with complications’
FTs	4.76%	4.72%	–0.04 % points	
Non-FTs	5.30%	6.05%	+0.75 % points	
Simple				–0.02 % points ^{**}
Adjusted				–0.03 % points ^{**}

Notes: ** p<0.01

Table 5.49 FTs’ DiD with Scotland in proportion of ‘with complications’ spells in all normal delivery spells in 2003/4 and 2004/5

	2003/4	2004/5	Change in proportion of ‘with complications’	Difference in change in proportion of ‘with complications’
FTs	4.76%	4.72%	–0.04 % points	
Scotland	2.63%	2.35%	–0.28 % points	
Simple				+0.24 % points [‡]
Adjusted				+0.24 % points [‡]

Notes: ‡ not significant at p<0.05

Table 5.50 Non-FTs' DiD with Scotland in proportion of 'with complications' spells in all normal delivery spells, 2004/5-2005/6

	2004/5	2005/6	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
Non-FTs	5.26%	5.98%	+0.72 % points	
Scotland	2.35%	2.53%	+0.18 % points	
Simple				+0.54 % points ^{**}
Adjusted				+0.59 % points ^{**}

Notes: ** p<0.01

N08: Assisted delivery 'with complication, versus N09: Assisted delivery 'without complication'

We investigated whether there was an increase in the proportion of assisted deliveries 'with complication'. We found little evidence to support the expectation of increased coding of deliveries with complications. As can be seen in Tables 5.51 to 5.53, the 'with complications' grew more slowly or fell more quickly than 'without complications' in our treatment groups than in the controls. The statistically significant result in Table 5.51 is in the opposite direction to our expectations.

Table 5.51 FTs' DiD with non-FTs in proportion of 'with complications' spells in all assisted delivery spells in, 2003/4-2004/5

			Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
FTs	8.97%	8.35%	-0.62 % points	
Non-FTs	9.10%	9.08%	-0.02 % points	
Simple				-0.15 % points ^{**}
Adjusted				-0.22 % points ^{**}

Notes: ** p<0.01

Table 5.52 FTs' DiD with Scotland in proportion of 'with complications' spells in all assisted delivery spells in 2003/4 and 2004/5

	2003/4	2004/5	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
FTs	8.97%	8.35%	-0.62 % points	
Scotland	2.75%	2.37%	-0.38 % points	
Simple				-0.23 % points [‡]
Adjusted				-0.19 % points [‡]

Notes: ‡ not significant at p<0.05

Table 5.53 Non-FTs' DiD with Scotland in proportion of 'with complications' spells in all assisted delivery spells, 2004/5-2005/6

	2004/5	2005/6	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
Non-FTs	9.01%	9.15%	+0.14 % points	
Scotland	2.37%	2.79%	+0.42 % points	
Simple				-0.29 % points [‡]
Adjusted				-0.26 % points [‡]

Notes: ‡ not significant at p<0.05

N10: Caesarean section with complication versus N11: Caesarean section without complication

We investigated whether there was an increase in the proportion of caesarean section with complication. FTs had statistically significant increases in the proportion of HRG N10 compared with Scotland but experienced decreases compared with non-FTs in 2004/5. In 2005/6, the difference between non-FTs and Scotland is not statistically significant. This indicates a change in the coding (or treatment) behaviour for caesarean section by FTs (but not by non-FTs) associated with the introduction of the tariff.

Table 5.54 FTs' DiD with non-FTs in proportion of 'with complications' spells in all delivery spells, 2003/4 to 2004/5

	2003/4	2004/5	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
FTs	14.37%	15.46%	+1.09 % points	
Non-FTs	15.31%	15.37%	+0.06 % points	
Simple				-0.15 % points ^{**}
Adjusted				-0.20 % points ^{**}

Notes: ** p<0.01

Table 5.55 FTs' DiD with Scotland in proportion of 'with complications' spells in all delivery spells, 2003/4 to 2004/5

	2003/4	2004/5	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
FTs	14.37%	15.46%	0.09 % points	
Scotland	4.71%	3.80%	-0.91 % points	
Simple				+2.00 % points ^{**}
Adjusted				+1.60 % points ^{**}

Notes: ** p<0.01

Table 5.56 Non-FTs' DiD with Scotland in proportion of 'with complications' spells in all delivery spells, 2004/5 to 2005/6

	2004/5	2005/6	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
Non-FTs	15.28%	15.66%	+0.38 percentage points	
Scotland	3.80%	3.61%	-0.19 percentage points	
Simple				+0.56 percentage points [‡]
Adjusted				+0.31 percentage points [‡]

Notes: ‡ not significant at p<0.05

5.11.3 Treatment for head injury

A32 A33: Head injury without brain injury versus H63 H64: Head injury

There are two groups of HRGs that relate to head injury - some in chapter A of the HRG classification system and some in chapter H. Tariffs for HRGs in chapter A are higher than those in chapter H. There is concern that cases could be coded to generate the higher chapter A HRGs rather than chapter H. We examined the proportion of A32 and A33 relative to H63 and H64. We focus on non-elective activity and present

the trends in addition to the DiD. The trends in Table 5.57 show that the proportion of Chapter A spells has been falling for non-FTs and FTs from 2003/4 to 2005/06.

Table 5.57 Trends in treatment of head injury: Proportion HRGs of A23 and A24 and proportion of elective care

		Year		
		2003/4	2004/5	2005/6
Non-FTs	No. of Spells	29,832	33,647	34,549
	% of A chapter	16.47 %	14.59 %	13.64 %
	% of elective	1.22 %	1.40 %	1.25 %
FTs	No. of Spells	6,846	6,885	6,866
	% of A chapter	17.24 %	16.25 %	15.64 %
	% of elective	1.04 %	1.55 %	1.45 %
Scotland	No. of Spells	8,171	7,244	7,058
	% of A chapter	18.95 %	20.63 %	20.18 %
	% of elective	5.82 %	7.38 %	5.41 %

The DiD in Tables 5.58 and 5.59, when we have adjusted for age-sex composition and the Trust effects, confirms that there has been no increase in the proportion of Chapter A coding (or activity) associated with the introduction of the tariff.

Table 5.58 FTs' DiD with Non-FTs in proportion of Chapter A, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
FTs	5.39%	4.92%	-0.47 % points	
Non-FTs	5.02%	4.12%	-0.90 % points	
Simple				-0.29 % points ^{**}
Adjusted				-0.29 % points ^{**}

Notes: ** p<0.01

Table 5.59 FTs' DiD with Scotland in proportion of Chapter A, 2003/4-2004/5

	2003/4	2004/5	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
FTs	5.39%	4.92%	-0.47 % points	
Scotland	3.85%	3.94%	-0.09 % points	
Simple				-0.55 % points [‡]
Adjusted				-1.18 % points [*]

Notes: ‡ not significant at p<0.05 * p<0.05

Table 5.60 Non-FTs' DiD with Scotland in proportion of Chapter A in all non-elective spells, 2004/5-2005/6

	2004/5	2005/6	Change in proportion of 'with complications'	Difference in change in proportion of 'with complications'
Non-FTs	4.14%	3.71%	-0.43 % points	
Scotland	3.94%	3.54%	-0.40 % points	
Simple				-0.04 % points [‡]
Adjusted				+0.21 % points [‡]

Notes: ‡ not significant at p<0.05

5.11.4 Cardiology and general medicine outpatients

The tariff for cardiology outpatients is lower than for general medicine and it is argued that this activity is simply being coded under general medicine instead to attract the higher tariff. We investigated whether under PbR there is a proportional shift in activity from cardiology to general medicine. The results presented in Table 5.61 to 5.63 show that there was growth in the proportion of cardiology outpatients by FTs and non-FTs. However none of the DiD results are statistically significant suggesting that the growth was not associated with the introduction of the tariffs.

Table 5.61 FTs' DiD with Scotland in outpatient attendances for cardiology as a proportion of cardiology and general medicine, 2005/6 and 2006/7

	2005/6	2006/7	Change in proportion of cardiology outpatients	Difference in change in proportion of cardiology outpatients
FTs	36.68%	40.01%	+3.33 % points	
Scotland	40.54%	42.99%	+2.45 % points	
Simple				+5.3 % points [‡]

Notes: ‡ not significant at p<0.05

Table 5.62 FTs' DiD with non-FTs' in the proportion of all outpatient attendances for cardiology as a proportion of cardiology and general medicine, 2005/6 and 2006/7

	2005/6	2006/7	Change in proportion of cardiology outpatients	Difference in change in proportion of cardiology outpatients
FTs	36.68%	40.01%	+3.33 % points	
Non-FTs	39.33%	43.04%	+3.71 % points	
Simple				-2.1 % points [‡]

Notes: ‡ not significant at p<0.05

Table 5.63 Non-FTs' DiD with Scotland in the proportion of all outpatient attendances for cardiology as a proportion of cardiology and general medicine, 2005/6 and 2006/7

	2005/6	2006/7	Change in proportion of cardiology outpatients	Difference in change in proportion of cardiology outpatients
Non-FTs	39.33%	43.04%	+3.71 % points	
Scotland	40.54%	42.99%	+2.45 % points	
Simple				+7.3 % points [‡]

Notes: ‡ not significant at $p < 0.05$

5.11.5 Summary of results on up-coding

We have investigated six pairs or groups of HRGs for evidence of such activity. We examined changes in the proportions of 'with complications' in maternity care and instances elsewhere (in hip replacement and head injuries) where such an unintended incentive, associated with differences in the tariffs, was perceived.

We found very limited evidence of a change in the pattern of coding or treatment of patients associated with the introduction of tariff. Of the six investigations, we found that only the coding (or perhaps practice) of caesarean section by FTs and normal delivery by non-FTs had changed in the direction expected if up-coding is happening.

It should be noted that the introduction was expected to be accompanied by greater transparency in the system and that the system encourages more accurate and complete coding of patients. It is not possible from this analysis to determine whether the very limited up-coding we identified was inappropriate or due to increased accuracy.

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